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Comparative Principles of The Structure of The Psyche of Homo Sapiens And Artificial General Intelligence - PART 1

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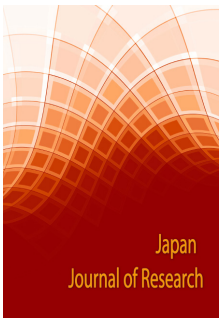

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Abstract

Properly understanding the structure and dynamics of mental processes is a critical step in determining the significant features of artificial general intelligence operating on the principles of biological systems. The psyche, as a function of the brain, is responsible for creating, preserving, integrating and determining the priority of updating the arsenal of regulatory algorithms that ensure the balancing of physiological and mental homeostasis. Two interdependent information circuits develop simultaneously in the psyche: 1) physiological - control and balancing of homeostasis parameters of the internal environment; 2) psychological - a) creating/maintaining a consistent picture of the external environment and the relationship with it; b) implementation of behavior algorithms to balance homeostasis. The supra-threshold dissociation of homeostasis parameters, both physiological and mental, updates a compensatory need, the encoded information equivalent of which is the goal image, becomes the motive for goal-directed behavior. The psyche uses consciousness for selective interaction with the external environment. Consciousness is the interface of the psyche and the external environment with the selection and control functions of the dynamics of the two-way flow of information in the process of fulfilling a need. In creating motivating frustration structures, the Homo sapiens (HS) creative psyche has modified consciousness into an independent subsystem of the psyche capable of arbitrary, volitional control. The HS psyche is now able to arbitrarily determine the relevance and parameters of goals beyond vital needs, keep their dynamics in focus, and through introspection construct subjectivity in phylo/ontogenesis. Expanding the range of needs beyond the vital arsenal has formed motivational constructs of ideal content, creating the "uncertainty barrier problem." The general principles of the psyche's action to realize ideal needs under conditions of uncertainty are formulated. The need to overcome "uncertainty barriers", with the a priori impossibility of achieving the ultimate ideal goal of a symbol creates a sequence of homomorphic cycles of behavior that have no prospects of completion.

Materials and discussion

To determine significant features and program artificial general intelligence (AGI) based on the principles of operation of biological systems, it is important to understand the structure and dynamics of brain/psychic processes that explain externally observable behaviors. The psyche, as a function of the brain, is a system responsible for creating, preserving, integrating, and determining the priorities for updating the arsenal of regulatory algorithms, the overall goal of which is to create/balance the homeostasis (physiological and psychological) of a biological organism. Algorithmic reproducibility can be identified by memorizing the precedent and rediscovering it.

We consider the human being as a liquid biological system (LS) existing in a gaseous environment (GE) from birth. The LS tends to a parametrically stable state - homeostasis (H), being in a state of unstable "current equilibrium". Balancing the physiological equilibrium state - homeostasis, within the boundaries of the "norm" (confidence interval parameters, CI) is realized by dynamic perceptual control and an arsenal of regulatory algorithms for status correction. From the time of birth, the body develops, in addition to existing ones, new physiological mechanisms, including the ability to exist in a gravitational field (in contrast to the previous immersion weightlessness in amniotic fluid); the appearance of the respiratory gas exchange function; synchronization of circadian rhythms, etc. Our ideas about the various homeostasis regulation mechanisms have been published previously [1,2].

In this paper, we do not present the described dynamics of mental development in the initial stages. During ontogenesis, the HS psyche forms a consistent picture of the environment and interaction with it. Projection mechanisms of the psyche, endowing "image" > "meaning", form motivating constructs of ideal content: symbols (image + meaning) [3-5]. The dominant influence of the social environment on all vectors of psychological development of

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the HS is illustrated by the fixed final level of the psyche of feral children [6]. Psychological homeostasis consists in balancing formed ideas about the structure of the environment with reality dynamics.

In other words, two interdependent integral information circuits are created and develop simultaneously in the psyche: 1) physiological - control and balancing of physical, chemical, and gravitational parameters of homeostasis of the internal environment; 2) psychological -

a) creating and maintaining a consistent picture of the external environment and relationships with it - "system 1" [7]; b) implementation of coded behavior algorithms to balance homeostasis - "system 2" [7]. Both circuits at the completed stage of development have the properties of systemic matrix structures with stable parameters. The psyche's main function is to balance and maintain the parametric constancy of both circuits.

The organization of the dynamics of activated neurons is a sign of involvement in a system where the structuring of all processes is the information equivalent of the result, i.e. the "future"[8]. In psychological time, the appearance of the expected result (goal image) is taken as an abstract point in the future, which is a psychophysiological stimulus for the updating of the dominant (D) and the starting point for the formation of an evaluation scale for the speed of achieving the result (psychological time). The present "is always a certain time interval" [9]. The goal image (GI), located "in the future" and containing meaning, becomes a motive. The main goal of any biological object is to ensure existence "now and in the future", which determines the structure and vector of "motive" as a construct of the psyche covering a temporal perspective. In other words, the formation of a goal image is an advance of structure before function.

Neurobiological phenomena of mental anticipation have been described repeatedly [10]. Anatomical structures are formed in embryogenesis long before they are needed [11). We believe it possible to state that anticipatory forecasting is the biological organism's principle of existence.

The constructive result of brain/psyche activity is "nervous and cognitive" [12] constructs that control regulatory algorithms (D). In this message, "D, dominant" is a generalized definition of organized hierarchized regulatory constructs of cognitive information.

Suprathreshold (exceeding the boundaries of CI) dissociation of "current equilibrium" parameters, both physiological and mental, updates the compensatory need (N). The current encoded information equivalent of the need (goal image) becomes the dominant focus (D), a resonant operator, a generator of structures of goal-directed behavior, leading to the restoration of H, satisfaction of the need and loss of relevance of the D [13].

In other words, D is formed, preserved and implemented by neural associations containing the encoded information equivalent of the need (goal image), with the potential to generate mental constructs for the period of relevance of D. The D that is displaced from consciousness (loses relevance) retains a stable frequency electro/magnetic pattern (code) of the image parameters (information equivalent of need) [14].

All types of perceptual information have the same physical nature, being transformed in receptor fields into electrical (frequency) and magnetic patterns with transfer to the projection fields of HB analyzers. Packaging of perceptual information occurs through space-time transformation (STT): transformation of the energy of the physical carrier at the entrance to the system; transfer to analyzers; divergence/convergence; updating; repression (loss of relevance); compression (reducing redundancy while maintaining informativeness [15]). The source of input information for STT is repeated perceptual/cognitive cycles across the entire spectrum of life activity (physiology/psychology). We share the idea of life activity as a space-time continuum that is regulated by a continuum of neurophysiological, vegetoemotional, somatofunctional reactions of the whole organism [16]. Our earlier data [1,2, etc.] allow us to determine the dynamics of the configuration and vectors of interdependent changes in the continuum of metabolism and hemodynamics, ensuring the balancing of physiological homeostasis for both the "norm" and "pathology". We consider the metabolic continuum as a matrix of physiological norms [1), comparison with which allows us to determine the vectors of changes in metabolism/hemodynamics (i.e., the dynamics of physiological regulatory algorithms) in any pathology. Significant changes in physiological (CI limits) and mental (boundaries of hidden frames) parameters initiate targeted search (adaptive) behaviors aimed at eliminating imbalance, adjusting and restoring homeostatic parameters of the body.

Adaptive (including creative) oscillations that go beyond the boundaries of the norm (CI/frames) allow determining new optima of system functioning,vectors of adaptation to the parameters of changes in the external environment, and reduce the degree of uncertainty [4].

The psyche carries out selective interaction with the external environment in the subject/object system through "consciousness" (C), one of the mechanisms of which is the function of arbitrary attention. "Attention is necessary for conscious mental effort associated with the subjective sense of activity, choice, and concentration" [7]. We consider "C" as the interface between the psyche and the external environment, the main function of which is the dynamics and control of the two-way flow of information of the current information equivalent of the need (D) in the process of implementation. We believe that structurally, "C" is a network gateway (NG) of the psyche responsible for controlling the conversion and selection of incoming information and outgoing effector algorithms for regulating "H", from the scope of which all types of automatisms are excluded. Initially, "C" has the functions of selecting target information, monitoring and tracking the dynamics of achieving the final goal within the boundaries of satisfying vital needs. The creative psyche of HS, creating frustration constructions outside of vital needs, modified and integrated the initial control function into an independent functional subsystem of the psyche with the capabilities of arbitrary, volitional control of goal selection. We believe that in this way the creative psyche of HS gained the opportunity to arbitrarily (selectively) determine the relevance and parameters of goals that are beyond satisfaction of vital needs, keeping their dynamics in the focus of attention, through introspection constructing subjectivity (personality) in phylogeny/ontogenesis. In other words, the creative psyche of HS has expanded the range of interaction with the external environment beyond the limits accessible to other biological species. We understand creativity as the ability to: produce prognostic hypotheses that cannot be deduced from initial conditions [16,18]; create stable mental constructs in the absence of a perceptual source and not requiring reactive

behavior; construct adaptive forms of goal-directed behavior in conditions of environmental uncertainty.

Through consciousness, as the interface of the "psyche-external environment" system, in a state of wakefulness, vector balancing of physiological and psychological homeostasis is ensured. The inversion of "C" in the sleep state has other functions [17].

As the social environment becomes more complex (maturing in ontogenesis), the range of needs expands, which construct increasingly complex regulatory algorithms of personal, cooperative, and social behavior. The phylogenetic cumulative effect of consciousness modification led to the emergence of the highest form of mental structure - personality, forming personal/social motivational constructs of "ideal" content (ethical/aesthetic/normative, etc.).

A significant constructive factor in the evolution of HS was a new need for hominids: achieving a “current balance” with the regulatory creative construct of the psyche - the symbol [3,4]. The essence of this need is the desire to eliminate frustration, which has no resolution due to the impossibility of isomorphic parametric alignment of dynamic images with the "symbol" (frustrating goal) [18]. Homomorphic (with respect to the symbol) forms of behavior have many achievable stage goals of approaching the “symbol”, creating vector dynamics of personality/society and stimulating the development of applied technologies, catering to socio-cultural needs, reducing frustration (up to the period of singularity)[3,19]. The maximum frustration tension at the starting position periodically decreases as stage homomorphic similarities to the expected result are achieved, determining the preferred vectors of development.

Needs encourage the subject to interact, motivating goal-directed behavior to interact with material, social and ideal objects. All these categories of objects have structural (qualitative) characteristics, in selective interaction with which the needs of the subject are combined with the parameters of the object. Before the advent of the HS psyche, a set of objective reality parameters determined the nomenclature, content and methods of satisfying needs [20]. The emergence of socio-cultural needs has formed a progressively increasing series of frustrations of ideal content that cannot be satisfied and create homomorphic options for approaching a goal that is beyond the achievable [3,4].

The creative psyche of HS transformed objective reality by supplementing it with a mental product and creating a unified two-component information space - an information universe (IU - 19), which integrated segments of objective and virtual reality. Information from the intermediary of the individual/society relationship was transformed into the "form and content" of reality, determining the probabilistic behavior of the system based on the transformation and potential properties of the environment.

The driving force behind the development (both biological and mental) of all living things is the overcoming of various barriers, the basis of which is the relationship between the energy of rest and movement [21]. When applied to HS, this developmental dynamics is a correlation of necessity (need), possibility and reality, which, interfering with the phenomenon of time, gives rise to the problem of uncertainty. HS constantly faces an uncertainty barrier (UB), which takes on various forms [20]. We understand uncertainty as the variability of choice with multiple alternatives and the absence of clear criteria for optimality and efficiency. Uncertainty becomes higher the more equally probable the various scenarios are, reaching a maximum when an unlimited number of sentences have the same probability of truth for the subject. All uncertainty is conditioned by the fundamental factor of time, the psychological essence of which lies in the continuous transformation of uncertainty into relative certainty. This is the ultimate goal of all interactions [20]. There are ideas about uncertainty as a fundamental property of nature [22].

The creation by the creative psyche of HS of frustration structures that form qualitatively new needs and increase the degree of uncertainty in the external environment has formed the predetermination of cyclical cognitive dynamics of development. With each new cycle of frustrating complexity of the external environment, HS looks for options to satisfy the next need and overcome the uncertainty barrier. Overcoming the UB, completing the cycle of approaching the goal (symbol), temporarily reduces frustration tension, rewarding the individual/society with positive feedback for the energy expended and forming a preferred vector for subsequent dynamics. The a priori impossibility of achieving the final goal (symbol) creates the next stage of homomorphic approximation, the need to overcome a new UB, constructing the next cycle in a series of sequences that have no prospect of completion.

Conclusions

To build an artificial general intelligence based on the principles of functioning of biological systems, some regulatory properties of the psyche of these systems should be taken into account: 1) the purpose of the psyche is to create and balance the mobile equilibrium of the internal environment in interaction with the external environment, through an arsenal of regulatory algorithms; 2) the impulse to start an action, the updating of the regulatory algorithm arises as a result of a significant internal imbalance; 3) the actual regulatory algorithm has a conscious information encoded equivalent: the goal image; 4) the goal image is the motive for goal-directed behavior, the result of which is the elimination of internal imbalance; 5) goal images that go beyond vital needs motivate the individual/society with frustrations, create uncertainty barriers and form homomorphic forms of goal-directed behavior (HFB); 6) HFBs implement cycles of approaching the final goal, with positive feedback: encouragement in the form of reducing frustration tension; 7) the dynamics of cycles of approaching the final goal - frustration, has no prospect of completion; 8) the sequence of completed cycles of HFB creates vectors of preferred development following the completion of each cycle, forming a coordinate system and the possibility of probabilistic forecasting; 9) arbitrary goal setting beyond vital needs with focusing, fixation, retaining the goal image in the field of attention and introspection, forms the properties of subjectivity and personality; 10) the HS psyche functions in a two-component environment (real/virtual), perceived as a single one; 11) anticipatory forecasting is one of the principles of the existence of HS.

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