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Research Article

Body and Mind through the Lens of Mechanistic Metaphors: A History of Semantic Aberrations

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Abstract

The mechanistic profile of the computer metaphor of consciousness has special attractive properties. The history of the formation of mechanistic explanations of the nature of the mind indicates a deep relationship between the methods of the epistemology and the level of development of engineering and technical knowledge of a particular era. The semantic transfer of the properties of mechanisms or machine computers to the idea of the structure of the body and the principles of the mind indicates figurative universals that have been preserved in the computer metaphor of recent times. Despite the rapid growth of knowledge and technology in the field of computer science, the computational approach to explaining the nature of mind and consciousness continues to retain archaic mechanistic features. At the first stage of the discussion, I turn to the key question of the reasons and cultural context for the transformation of the expression "The body is a machine (mechanism)" into the expression "The mind is a machine (mechanism)." Due to its technological efficiency, the ideology of mechanicism formed in European cognitive culture the logical principle of transferring bodily properties to mental properties, despite the obvious contradictions. This paper provides a detailed analysis of these contradictions. The paper goes on to substantiate the connecting link between the psychophysical problem of consciousness and the reduction of mathematical functions to computational procedures implemented through physical machine calculation has become a connecting link in the psychophysical problem of consciousness. From a mechanistic point of view, a computing machine began to represent a motor and comparative model of the work of thinking. The final part examines the further evolution of computationalism and the correlation of the methods of this approach with discoveries in the field of computer science. The reasons for the "stability" of the mechanistic vocabulary in modern cognitive sciences are identified.

Keywords: Computer metaphor; Mechanicism; Computational theory of consciousness; History of computing; Functionalism

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Научная статья

Тело и разум в оптике механистических метафор: История смысловых аберраций

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Аннотация
Механистический профиль компьютерной метафоры сознания обладает особыми притягательными свойствами. История становления механистических объяснений природы разума указывает на глубинную взаимосвязь методов философской теории познания с уровнем развития инженерно-технического знания той или иной эпохи. Смысловой перенос свойств механизмов или машинных вычислителей на представление об устройстве тела и принципов работы ума указывает на образные универсалии, которые сохранились и в компьютерной метафоре последнего времени. Несмотря на бурный рост знания и технологий в области компьютерных наук, компьютационалистский подход к объяснению природы разума и сознания продолжает сохранять архаичные механистические черты. На первом этапе рассуждений мы обращаемся к ключевому вопросу о причинах и времени трансформации выражения "Тело – это машина (механизм)" в выражение "Разум – это машина (механизм)". В силу своей технологической эффективности идеология механицизма сформировала в европейской познавательной культуре логический принцип переноса телесных свойств на свойства ментальные, не взирая на очевидные противоречия. В данной работе дается детальный анализ этих противоречий. Далее в статье обосновывается рассуждение о том приведение математических функций к вычислительным процедурам, реализуемым через физический машинный счет стало связующим звеном в психофизической проблеме сознания. Вычислительная машина с механистической точки зрения стала представлять собой двигательную и сопоставительную модель работы мышления. В заключительной части рассматривается дальнейшая эволюция компьютационализма и корреляции методов этого подхода с открытиями в области компьютерных наук. Раскрываются причины "устойчивости" механистического словаря в современных когнитивных науках.

Ключевые слова: Компьютерная метафора, Механицизм, Вычислительная теория сознания, История вычислительной техники, Функционализм

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INTRODUCTION

This article continues and expands on ideas presented in a previous publication (Baryshnikov, 2023). which also proceeded from key considerations regarding the origin of scientific metaphors.

The role of conceptual metaphor in scientific and technical cognition has been well studied. The principle of the transfer of properties by analogy is a powerful heuristic mechanism that provides for the birth of explanatory theories and working mechanisms from bold, almost poetic comparisons. There are several approaches to studying the cognitive functions of metaphor. In metaphor as a mechanism for the formation of conceptual forms of thinking, a number of functions are traditionally distinguished: heuristic, hypothetical, prognostic, simulating, nominative, axiological, etc. Despite its long history, Russian and international researchers continue developing the topic of metaphor in scientific knowledge (Amin, 2009; Chi, & Slotta, 1993; Kuzmina, 2019). A second key consideration refers to the results of cognitive research of metaphor as a key tool of knowledge generation lying at the junction of language, body, and consciousness. In order not to plunge into the incredible volume of publications on this topic, it may be enough to cite Steven Pinker's review chapter (Pinker, 2016, pp. 290-336).

Before proceeding, some central terms should be clarified:

- *A machine* is a device that performs mechanical motions to transform energy, materials, and information.
- *A mechanism* is a system of bodies designed to convert motions of one or several bodies into constrained motions of other bodies (Nosko et al., 2002).
- *A computer* – here, a computer represents two mathematical abstractions (outside the context of their technical implementation):
    - a finite state machine (FSM) capable of reading sequences of input data
    - a Turing machine as a computationally complete extension of a finite state machine, capable of changing input data through formal transition rules.
- *A metaphor* is a figurative transfer of properties from one predicate to another while preserving the original lexical form filled with new content.
- *A combinatorial algorithm* is a rule describing the method of constructing a certain system of connections out of elements of the original set.
- *A computational algorithm* is a command for executing computational transformations of input data into a result completely determined by these data.
- *The Church-Turing thesis* (in terms of Turing computability) states that any algorithmically calculable function may be computed by a Turing machine that calculates the values of this function.

This allows for the formulation of two baseline statements:

Statement 1: Deconstructing the metaphors used in an established "language game" is a way to understand the epistemic value of the game itself (which includes entire paradigmatic systems with sets of axioms, theories, hypotheses, rational beliefs and the like (Peels, 2018)).

Statement 2: Legitimate semantic transfers (metaphors) in scientific knowledge adapt language to the causal structure of the world, i.e., bring word usage to a consistent form.

Further considerations represent an analysis of the historical stages during the formation of the mechanistic profile of the computer metaphor, which occupies a strong methodological position in modern philosophy of consciousness. In my opinion, it is necessary to identify the reasons why the traditional "human (body) – machine" metaphor of the New Time was transformed into a more complex version of "mind – machine". What happened to the concepts of "mind" and "machine"? How have ideas about the properties of computational procedures changed? What makes the counterintuitive computer metaphor viable today? We will try to answer this series of questions or, at least, outline theoretical solutions. It is also worth noting in the very beginning that I proceed from the fact that the analysis of linguistic expressions in itself is not capable of clarifying the question of whether matter, brain, and mind are representatives of the category of "computational systems" or do we simply say so? The problem is that no amount of empirical validity provides sufficient criteria for separating the truth of a linguistic expression from the "*façon de parler*" ("manner of speaking").

OBSERVATIONS, FUNCTIONS AND MECHANISMS, AND THE INDEXING PROBLEM

Earlier in my previous work, I pointed out the not entirely obvious (at least requiring additional justification) historical relationship between the developmental stages of the engineering sciences related to computing machines and philosophical teachings about „man" and the nature of the human mind (Baryshnikov, 2022). Indeed, since the early days of philosophy, historical types of ideas about human cognitive mechanisms were closely related to the level of development of logical and linguistic theories as well as engineering and technical knowledge. A peculiarity of this parallelism is presented through the relationship between the development of computer technology and ontological and epistemological concepts. The correctness of this thesis can be illustrated with a large number of examples – from the combinatorial argumentation system of Ramon Llull to Athanasius Kircher's "Mathematical Organ", the "Leibniz wheel" to the modern wooden Turing machine built by Richard Ridel (2016). There are fundamental works devoted to the role played by machine analogies in the formation of cognitive sciences (for example, (Boden, 2008, p. 200)). Let me point out that for simplicity of presentation I will not distinguish between the concepts of "computing machine" and "logical machine," because in this context the specification of the problems solved by computation is irrelevant (For more information about the problem of defining the concept, see (Shilov, 2019, pp. 8–11)).

Here I am interested not so much in the engineering side of the matter of the mechanistic computationalism origins, but in the problem of a new "language game" formation. At a certain stage, the rules of this "game" included the practice of using a "machine vocabulary" when discussing classical philosophical issues concerning cognitive processes; and vice versa – the metaphorical vocabularies of philosophy and cognitive sciences have entered the word usage practices of computer engineers (Starjyk & Prasad, 2011). It is also worth distinguishing between naive mechanicism – the key provision of which is expressed by the following formulation: the mind is a kind of causal mechanism, a natural phenomenon that behaves according to system rules regularly like the liver or heart (Crane, 2003, p. 1) – and the mechanistic position in the debate about the definition of an effective computable function. According to this position, the human mind is represented as the result of a calculating automaton that is capable of understanding the content of a Gödel sentence.

As the primary methodological basis for this work, I use a synchronic approach, applicable in a number of historical and cultural disciplines. The advantage of this approach is that interdisciplinary analysis (from literature, architecture, and philosophy to the history of technology and everyday culture) of any historical era allows us to find non-obvious relationships and identify their causes (Glazychev, 1989, pp. 8–10). It is impossible to implement the entire plan within the scope of the article, but taking the first step is possible. I believe that traces of semantic transfer that appeared during the formation of a mechanistic picture of the world can be found in scientific and philosophical texts.

If this approach is applied to the mechanistic profile of the computer metaphor and its historical contextual vocabulary, then the key question will be when did the expression "The body is a machine (mechanism)" transform into the expression "The mind is a machine (mechanism)" and what were the causes of this transformation? That is, it is necessary to trace the connection between technological images and ontological and anthropological pictures in a synchronic view. Hidden in these seemingly simple expressions are historical representations of such concepts as matter, function, measure, calculation, algorithm, truth, and mechanism.

The etymology of the Greek word "μηχανή" immediately gives a reference to machine functionalism. In general terms, all dictionary meanings of the term "μηχανή" can be reduced to the following series: tool, device, means, method, opportunity, trick (Dvoretsky, 1958). This series of synonyms indirectly indicates two main characteristics of functionalism: multiple realizability and neutrality of function. Note that the Latin word "functio" itself goes back to the verb "fungere" (to perform, carry out, fulfill duties). In my opinion, both characteristics are the result of metaphorization processes. Forming the vocabulary of the language game in a particular subject area, the expression "X is similar to Y" turns first into the expression "X functions like Y" and then into "X is Y." If X functions like Y, then X inherits the sets of rules that Y obeys. The search for universal rules is one of the key features of the functionalist approach. It is not difficult to understand that the search for universal rules for the functioning of the mind, coupled with the expansion of anatomical knowledge and the complication of computer technology, ultimately led to technological parallelism "The mind is a machine." This technological parallelism is the result of metaphorical transfer.

Actually, Nature was the first "observable mechanism" in the history of humankind, and it still is. Inventing megalithic or other architectural "instruments" for observations and timekeeping, humans created systems of technical indices that designated and predicted events through the states of this "mechanism." It would not be an exaggeration to say that the first observatories and gnomons (from the Greek Γνώμων – pointer) became the first computing mechanisms. The functional and operational levels of the use of the first symbolic mechanisms are evident from the following quotation, which describes the method of predicting lunar events using the marks of Stonehenge (ca. 30th century BC): "It has been established that if you take three white pebbles a, b, c and put them into holes numbered 56, 38, 19, and then take three black pebbles x, y, z and put them in holes numbered 47, 28, and 10, and every year (say on the day of the summer and winter solstice) move the marker stones in a circle into adjacent holes, then this simple operation would allow to accurately predict all important lunar events over many hundreds of years" (Pipunyrov, 1982, p. 17). The mechanization of measurements is already evident in the first odometers (drums with pebbles on the axles, counting the "mileage" of a chariot) used by Archimedes (3rd century BC) and Marcus Vitruvius (1st century AD). Even at these early stages of technical thought development, the most important functionalist principle arose – *the state of the computing system indicates (is an index of) a real event or state of affairs.* It can be argued that any meaning of inferential expressions indicates their physical correlate. A fact of the physical world becomes a denotation of the signifier expressed in the functional state of the system. For machine functionalism, a stable correlation between the physical state of the system and the value in an abstract table cell is vital.

Over time, timekeeping instruments and spatial models of natural processes have been miniaturized. The mathematical component of observation and accounting evolved from the conventional marks on the fire or water clocks and angles, azimuths, and sunrise/sunset points of celestial bodies relative to the horizon to gear ratios of the wheel system. The observed dependencies of natural processes became representable through complex geometric relationships of angles and radii and the physics of a multi-stage gearbox. A unique example of an ancient astronomical calculator based on a wheel drive is the Antikythera mechanism (Merchant, 2017).

The history of computer technology indicates that the signified, associated with the indices of the simplest instruments (calculating frames, abaci, rosaries, stones), eventually shifted to the area of abstract mathematical ideas. The spatial model of the calculator now points not to the position of celestial bodies and not to the sequence of time periods, but to some mathematical facts in the user's head.

BODY AS A MECHANISM

In the history of humankind, mechanisms have always been applied tools that solve specific problems in the profane world of everyday life. Humanity had a supernatural status through which passed the border of the earthly and the heavenly, the profane and the sacred. This is clear from the history of medicine. In the late Middle Ages, the theological concept of "body" (σῶμα – torso, body), as something indivisible, was transformed into the medical concept of "organism" (ὄργανον – tool, instrument, machine) meaning a set of organs, instruments or mechanisms.

During this era, mechanized figures were used to create visual and emotional effects in missionary work. In the 15th century, the Rood of Grace at Boxley Abbey in Kent

(England) was a mechanized likeness of Jesus on the cross that moved eyes, lips, and other body parts (Groeneveld, 2007). Automated angels and animated biblical scenes were becoming commonplace: automata in the interior and exterior of churches were familiar features of the daily life of 15th-century townspeople (Riskin, 2016). On the one hand, these devices attracted pilgrims and were perceived by many parishioners as a miracle; on the other hand, the development of automata improved engineering and consolidated the metaphorical image of the body as a mechanism and movement as the change of position of a set of material points.

Design developments in the field of military gear played an important role in the formation of mechanistic ideas about the body. The development of fastenings, joints and hinges in the manufacture of knights' plate armor required a thorough study of the mechanical principles of the human body movement. Up to a certain point, "mechanics" as a worldview metaphor did not pretend to represent ideas about human nature and the structure of the Universe.

Later, in the 16th and 17th centuries, technological breakthroughs in the field of optics allowed to see the human body as many interconnected technical units. Galileo and Santorio's microscopes and thermoscopes made it possible to visualize the human body as a collection of smallest functionally interconnected parts. Authors of treatises on iatromechanics (from Ancient Greek ἰατρός and μηχανή, literal translation – "medical mechanics") believed "that the hand acts like a lever, the chest is like a blacksmith's bellows, the heart is like a pump, and the glands are like sieves" (Baglivi, 1827) (See also illustrations in the appendix to the treatise on biomechanics by G. Borelli "De Motu Animalium" ("On the Movement of Living Beings" (Borelli, 1680; Maquet, 1989).

From this perspective, the human body is a mechanism that changes its functional states. This view is reflected in the evolution of "metaphorical vocabularies" of medical knowledge, starting with the texts of Hippocrates and Galen (Boden, 2008). The essence of machine functionalism can be expressed in a formulation applicable to a technical device of any complexity, the use of which allows to expand the range of possibilities for the user: *the functional state of the system is the value of a set of tautological analytical expressions that describe this state of the system.* This statement can be illustrated through physical metaphors used in defining the functional properties of the cardiovascular system: "the functional states of the cardiovascular system include heart **rate**, blood **pressure**, stroke and minute **volumes**, **amount** of circulating blood, and blood flow **speed**."

As we see, even before the formation of a full-fledged Cartesian mechanistic paradigm, sets of metaphors (with components of elementarism and atomism) began to be used in language practice to express ideas about the body, life, movement, and general mechanisms of development. The term "mechanism" ceases to be an allegory and turns into a functional description of the studied structures of the human body and principles of thinking. René Descartes' mechanism is based on the problem of energy conservation and transmission, and on the intractable problem of physical causation. The main issue was not the search for universal rules that set the algorithm of action for bodily "mechanisms," but the reasons for the generation and transmission of vital energy and primary impulses. Looking at Descartes' style of philosophizing from the perspective of the history of cognitive sciences, his substance dualism (if) has set the direction for the development of two opposing approaches. On the one hand, empiricists, who derived all the properties of the system from experience, accepted the mechanistic paradigm in its pure form. It can be assumed that the concept of self-learning neural networks would not have been surprising, for example, to Thomas Hobbes. On the other hand, Descartes' ideas fueled the interest of rationalists in the search for innate ideas and universal concepts that make it possible to construct consistent judgments of a “universal science.” For instance, Gottfried Wilhelm Leibniz pointed to the “linguistic” foundations of Descartes' analytical geometry, emphasizing that bringing geometry problems to the form of equations allows designing an example of the use of a universal computational language that can consistently express all the true judgments of science.

Mechanicism as an ideology of the Enlightenment was strengthened due to successes in the design of mechanisms capable of performing quite complex actions (for example, the automatons of Jacques de Vaucanson (Fron & Korn, 2019)). Raising the question of mechanization of arithmetic operations became possible thanks to a number of discoveries in the field of theoretical mechanics, materials science, ballistics, and watchmaking. Note that Christian. Huygens' balance wheel created by him in 1674 finally made it possible to design precise chronometric instruments. This discovery led to developments in the construction of navigational and geodetic cartographic instruments. The application of uniform counting of abstract units to the dynamic states of bodies became the basis for discoveries in dynamics and kinematics. The convergence of applied aspects of mechanics with the implementation of abstract mathematical functions is also due to the fact that the principles of energy motion and conservation began to be conceptualized in an extremely abstract, idealized form. An example is Lazare Carnot's theorem “on the conservation of living forces,” which uses the term “absolutely inelastic impact” (Brodyansky, 2004). The history of computer technology clearly shows how machines capable of performing mechanical calculations became more complex and miniaturized. Forms of logical reasoning and rules that lead reasoning to true conclusions were implemented through arithmetic operations. Let us note that the practical significance of inventions such as “Pascalina” or Leibniz's stepper reckoner was only to speed up the process of voluminous routine calculations with the help of machines, and not to surpass humans in methods. Here lies the key principle of classical computationalism – *first formalize the procedures of human thinking, then implement a formal logical circuit in a computing device.* Thinking here means a computational algorithm of any complexity.

The problems that the developers of thinking algorithms encountered in the early stages were not of a conceptual, quantitative nature. Even in the early stages of using combinatorial algorithms when trying to create a universal language, thinkers were faced with the limitations of a system of signifiers of any power in relation to the properties of the Universe. The development of Llull's ideas through the efforts of Giordano Bruno, Paul Guldin, Marin Mersenne ended with calls for an infinite number of statements due to the endless generation of alphabetic atomistic systems (Eco, 2016, pp. 400-401). Quantitative problems associated with the strict requirement that the calculator be an index indicating the real state of affairs (no matter whether in the world or in the head of a mathematician or chess player) have accompanied the entire history of computer technology. Michail Moissejewitsch Botvinnik (1975) convincingly shows this in his reasoning about the algorithmic nature of the chess game. The number of possible chess positions is finite and enumerable, but creating a sorting and selection algorithm would require incredible resources (p. 9) (The history of overcoming the quantitative barrier with the help of machine learning is quite short and requires separate consideration. Here I refer the reader to the published results of my research (Барышников, 2021)).

Improving the principles of machine operations has expanded the class of problems that can be solved. The mechanics of abstract calculation, which makes it possible to automate the process of consistent reasoning, is no longer tied only to implementation through wheel-chain or steam drives. The task now was to formalize relationships and actions within the framework of logical rules. In the 17th to18th centuries, the possibility of creating a machine that mechanizes the process of arithmetic reasoning becomes a way to debunk the image of the human being as the highest Divine creation. The image and likeness of God, revealed in the intellectual creative process of humans, can now be enhanced by mechanical means. This is how a smooth transfer of images gradually took place. If "machine" is defined as "a device that performs mechanical movements to transform energy, materials, and information," then the logic of the transfer is expressed by the sequence below:

(1) The body is a machine.

(2) All derivatives of bodily functions are explainable mechanically (algorithmically).

- *a. The mind is derivative of bodily functions.*
- *b. Therefore, the mind is explainable mechanistically (algorithmically).*

(3) The mind is a machine.

Unlike expressions (2), (2a) and (2b), expressions (1) and (3) do not have a strict logical connection due to the absence of a purely metaphorical premise "everything that can be explained mechanically is a machine."

THE MIND IS A FUNCTION OF A MACHINE

Latin "functio" means "fulfillment", "execution." This is an instrumental action, the commission of which demonstrates the meaning (more precisely, the purpose) of this action. It is not difficult to imagine how the historical dispositions of the mechanistic picture of the world were transferred from the field of anatomy and physiology to the field of computational procedures. The development of watchmaking is closely related to the development of computing mechanisms. In the 16th century, in addition to crown and lantern wheels, gears, racks and wheels with triangular, rectangular and trapezoidal teeth are becoming increasingly common in watches. Designers were looking for a universal method for implementing mathematical operations; a method that would ensure minimal friction and durability of parts. Innovative in the mechanistic period of computer technology development was the idea that transformation of mathematical functions will reduce computational procedures to those operations that can be implemented through machine calculation. Thus, the idea of creating a universal language of logic is revived again. The expressions of this language could be realized in the symbols of mathematics and in the physical parameters of a computing machine. From a mechanistic point of view, a computing machine is a driving and comparative model of thinking operations. At the turn from the 16th to the 17th century, the classical philosophical problem of finding the foundations of a universal language is superimposed on the successes of engineering and the technical sciences. The history of the use of combinatorial algorithms in the theory of knowledge indicates that the reasons for such a search could be very different – from a religious-mystical explanation of the forms of divine reality to attempts at reconciling church institutions and harmonizing the political landscape (Eco, 2007, p. 277). One of the key questions in the philosophical search for a universal language in Leibniz's (1693/1991) formulation sounds quite simply: "What is the maximum number of true, false and even meaningless statements that can be formulated using a finite alphabet?" (quoted from Eco, 2007, p. 278).

The technical implementation of calculations can vary: these can be systems of wheels that transmit numerical values and summation functions to the output interface (Samuel Moreland's adding machine, Blaise Pascal's "Pascalina", Leibniz's stepped reckoner); or sticks marked so as to implement the "lattice" method of multiplication through comparison of rows (John Napier's bones, Claude Perrault's *Abaque Rhabdologique*); or a combination of both methods (Wilhelm Schickard's calculating clocks). Later, new architectures of "mechanical processors" will be implemented: Joseph Marie Jacquard's loom programmed by punch cards, Maurel and Jayet's s system of gear wheels with pointer indication "Aritmorel", and, finally, Charles Babbage's analytical engine, a device that was much ahead of its time (O'Regan, 2021). This machine already contained such elements as memory, an arithmetic unit, a control unit, and an input/output interface. In the article "On the Mathematical Powers of the Calculating Engine," Babbage describes the logical-arithmetic structure of his machine and puts forward the idea that such units will be able to implement the work of the brain. Let us pay attention to the fact that in this work Babbage already raises the question of analogies between machine procedures and mental procedures, and dwells on the ways of using these analogies (Babbage, 1982, p.31).

A key step in the invention of a universal abstract computer was the creation in 1936 by Alan Turing of a formal model that was complete and capable of transforming input data through elementary computational procedures into restructured output data. Methodological reduction has stopped (it is difficult to find something more elementary than the distinction between the symbols 0 and 1). The search for a universal description language stopped at a two-digit alphabet, but this has an undeniable advantage: the operation of logical electrical circuits is identical to Boolean algebra. The simplicity of implementing binary code through the states of electronic computers has led to the rapid growth of scientific knowledge in the theory of algorithms and computability, information theory. This led to the rapid development of technology, the growth of computing power, and the miniaturization of computers. Computer modeling has become "commonplace" since the so-called cognitive turn in philosophy and applications, which has led to a strong entrenchment of the computer metaphorical vocabulary in the sciences studying the brain, mind, thinking, and cognitive processes. The stages of the key ideas formation in the cognitive sciences of the 20th century are discussed in detail in the Howard. Gardner's (1998) work.

The whole variety of approaches that express the significant epistemological consequences of the metaphorical transfer of computing device properties to the functional morphology of the mind can be expressed in several provisions:

- Consciousness (mind) may be considered as a system that implements symbolic calculations. Information is represented in consciousness symbolically. The computer program and consciousness are realized through serial execution of procedural steps. Cognitive processes in this perspective acquire the properties of a discrete sequence of changeable states.
- The processed information is analyzed by registering calculation symbols (in terms of the Turing machine, printing symbols on a memory tape) and reducing mental operations to these symbols. Mental states in this case are understood as the result of processing different types of information.
- Information processing is organized according to the principle of stages distributed across modules of the entire system.
- Cognitive processes, like computer processing of information, occur over time. The duration and chronological sequence of each process can explain the nature of this process and the principles of its information organization.
- The mind (like any computing system) is a system with a limited set of functionality.

The classical Computational Theory of Mind with its symbolic combinatorial approach emerged due to the controversy surrounding the Church-Turing thesis associated with the restrictions that Turing proposed to impose on the configurations of human working memory. Actually, the answer to Leibniz's question about the possibilities of constructing statements in a limited alphabet is formed within the framework of technological breakthroughs of the first half of the 20th century. In their works, some authors give us the following generalizations, which directly indicate methodological limitations on the increment of "brute computational force":

- The directly recognizable symbolic configuration uniquely determines the next computational step.
- There is a fixed number of states that must be taken into account.
- Only directly recognizable character configurations are changed.
- New observed configurations are within a limited distance from the directly observed previous configurations (Ershov & Tselishchev, 2012).

A paradoxical situation arises here. The so-called human version of the Church-Turing thesis becomes true under the condition that "any function that can be calculated by a human computer is Turing-computable" (Tselishchev & Ershov, 2005). But at the same time, data from the empirical sciences of consciousness indicate that the work of consciousness and the brain does not satisfy any of the listed restrictions which are necessary conditions for the equivalence of thinking and calculation. Human mathematical operations are ontologically distinct from the effective computability function implemented in a Turing machine. In this case, mutually exclusive requirements must be applied to the human mind in terms of classical computationalism: 1) to implement effective Turing-type computation, the mind must implement functions that can be computed by a deterministic mechanical device; 2) in this case, the mind must be capable of realizing the truth of Gödel's sentence, which is not characteristic of deterministic mechanical devices.

CONCLUSION

The transfer of properties of technical systems and functional principles for the implementation of computational procedures has become the conceptual basis of the computer metaphor. I can use even stronger words: this transfer has become the figurative framework of the entire computationalist paradigm. Today, the combinatorial evidentiary mechanisms of Llull (Bonner, 1997), analogies of brain function and resonance in stringed musical instruments in the works of Julien Offray de La Mettrie, mechanistic design metaphors in the works of Descartes and Leibniz are well studied. In the course of technological development, the relationship between the ideas of electrodynamics and the principles of signal telecommunications (telegraph metaphor) was transformed into the so called "cybernetics of nervous activity." These analogies are widespread in studies of muscle tissue, the nervous system, and the brain (see the works of Ivan Michailovich Sechenov, Ivan Petrovich Pavlov) (Wiener, 2019). Technological breakthroughs in the field of mathematics, cryptography, and communication and information theory in the 1930–40's completed the formation of the computer metaphor in the theory of knowledge. It is obvious that the development of computational approaches to human cognition procedures has had a serious impact on the development of engineering methods of artificial intelligence. The enthusiasm that was characteristic of research in the 1960's regarding the integration of the methodology of artificial intelligence and cognitive psychology into a unified knowledge about the "mechanics" of human intellectual processes gradually gave way to a more balanced position. This tendency is due to the fact that the intentional properties of consciousness turned out to be much broader than representative functional procedures. Added to this was the unclear semantic nature of the calculated symbols themselves and the traditional psychophysical problem of consciousness which has not lost its relevance. However, today, during the "AI Thaw" at the stage of rapid development of large language models, I again see the return of the old "metaphorical dictionaries," but in an inverted form. Now, terms describing mental states and mental activity of a human being ("think", "see", "imagine", "recognize", "learn", "predict" "prove", etc.) are applied to large neural network models and the results of their calculations on an enormous array of data are without any reference to their metaphorical meaning. Hence gradually, in the practice of word usage, machines again acquire human features.

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