

Information causality

In the modern philosophy of consciousness, the theory of information causality is being developed, the essence of which is that information “is able to serve as a control factor (because the goal ... and the causal effect of control in a self-organizing system is determined precisely by information on the basis of the existing code dependence, and not by the physical properties of its carrier, as they may be different).

However, there is a problem with the concept of informational causality, due to the fact that if we do not allow the reduction of informational impact to the impact of the physical order, then the causal closure of the physical world is violated, since nonphysical (informational) data are embedded in the causal chains of physical events. In particular, recognizing the irreducibility of information causes to physical causes, we come to the conclusion that no knowledge of the physical structure of a living cell allows a priori (deductive) derivation of the mechanisms of protein synthesis, and in order to fully explain them, it is also necessary to add knowledge of information data that does not reduced to the physical structure and functioning of individual structural subsystems of the cell.

Thus, we are shifting towards creationist theory or the theory of intelligent design, according to which information is introduced into matter from the outside from a transcendental level of being. Therefore, the consistent development of the theory of information causality leads to the substantialization of information data, because information as an effective cause is likened to Platonic ideas that organize the existence of material systems and whose influence cannot be reduced to active causes of a physical type.

Substantiating the phenomenon of information causality, D.I. Dubrovsky in the second part of the article “A Critical Analysis of the Penrose-Hameroff Theory of Consciousness” emphasizes: “It has become generally accepted that the description of functional relations is logically independent of the description of physical relations. This alone indicates the impossibility of reducing information processes to physical ones.

One cannot agree with this statement, since functional relations are reduced to causal connections between individual substructures of a physical system acting as an information carrier, and causal connections between individual substructures of a physical system, in turn, are determined by physical laws, and therefore functional relations are logically derived from the description physical relationships.

For example, the functional states that a computer is in can be deduced from its physical states, since physical states define causal relationships, and causal relationships in turn define functional states. True, such a deductive conclusion today cannot be realized by any computational means, but it is fundamentally admissible, because if we assume the opposite, then the epistemological completeness of physics is violated and the behavior of a physical system at the proper physical level of being can no longer be described by appealing to physical laws alone. .

Identical functional states can be realized on substratally different physical systems, but the analysis of each of them at the physical level of being fundamentally allows a deductive conclusion of causal connections between individual physical substructures and, as a result, functional states inherent in these physical systems at a certain point in time.

Information causality means that code dependencies cannot be reduced to causal relationships between physical objects, the existence of which is subject to physical laws, but then the formation of code dependencies in information systems should be explained not by physical, but by superphysical reasons.

It turns out that the relationship between the encoded information and the coding object (for example, the binding of amino acids to nitrogenous bases in the DNA information code) is determined not by the natural course of the evolutionary development of material systems and not by random historical processes, but by some superphysical forces, the action of which can no longer be explained in within the framework of modern science, because otherwise, no matter how much we reduce the entropy (i.e., increase the structural complexity) of material systems, their behavior will still not go beyond the limits of physical phenomenology (i.e., under no circumstances will it show informational properties not reducible to the physical level of being).

If we allow the reduction of information impact to the impact of physical systems, then information causality as such becomes a form of physical causality, and it is no longer necessary to talk about the causal effect of the information order in self-organizing systems.

For example, an analysis of the information processes that accompany intracellular protein synthesis shows that in reality they are determined by chemical and electromagnetic laws, the knowledge of which is sufficient to a priori (deductively) deduce from the physical structure of the cell the mechanisms for the formation of amino acid chains as a result of the interaction of the ribosome and the replicated region of the molecule. DNA.

As a result, we come to the conclusion that informational causality as such does not exist, but there is only a convenient and compact way to describe a large set of physicochemical processes.

In order to preserve information causality as an ontological phenomenon and prevent the epiphenomenal nature of information in its qualitative aspect (because otherwise information data turns out to be an unnecessary, causally ineffective add-on to the processes of a physical order), supporters of the functional approach put forward different theories.

The American neuropsychologist R. Sperry, criticizing reductionism, singles out ascending and descending causality not only in relation to different levels of being with irreducible characteristics, but also to the same ontological level within which complex systems can be represented as a set of interacting elements. Thus, biological properties cannot be reduced to chemical properties, and chemical properties cannot be reduced to physical ones. At the same time, in his article "The Structure and Significance of the Revolution of Consciousness", R. Sperry argues that "consciousness is born as an emergent systemic property of high-level organizational processes occurring in the brain."

Agreeing with this point of view, we come to a violation of the principle of causal closure of the physical world, because both biological and chemical systems in their existential basis are a complexly organized set of interacting physical elements (elementary particles), and if we adhere to the bidirectional concept of causality R. Sperry, we must admit that the very behavior of physical elements in all its diversity cannot be explained by physical laws alone, and this, in turn, contradicts the principle of the epistemological completeness of physics and, ultimately, leads to the denial of the law of conservation of physical energy.

However, the law of conservation of physical energy is not violated either in chemical or biological systems, which is consistent with the principle of the ontological integrity of the material world and refutes R. Sperry's theory under consideration.

Take, for example, a wheel that rolls down a mountain. According to R. Sperry's bidirectional concept of causality, the movement of a wheel is determined not only by the physical interaction of the particles of which it consists, but also by its shape, which allows it to move with a minimum friction force. In this case, the shape of the wheel is a high-level (emergent) property as a result of the systemic interaction of particles, determined by the properties of the low-level order.

However, the shape of the wheel is completely determined by the physical interaction of the constituent elements and, as an emergent property, can be deduced from low-level properties without losing any essential characteristics.

Not all modern scientists recognize the causal isolation of the physical world, leaving an ontological and conceptual loophole for the effective role of consciousness in the organization of material existence. For example, G. Stepp states: "According to modern orthodox basic physical theory, but in contrast to many statements of the philosophy of mind, the physical sphere is not causally closed."

DI. Dubrovsky, defending the concept of informational causality, also opposes the principle of causal closure of the physical world, believing that physical causality is violated in such phenomena as the Big Bang or quantum effects of a non-local order.

However, such speculations do not stand up to scrutiny, since neither the Big Bang nor quantum effects of a non-local order violate physical causality, but simply obey physical causality of a different nature, different from the nature of physical causality, which is inherent in the phenomena of the classical world. If physical causality is violated, then miracles should be observed in the surrounding world, and not the "miracles" of quantum mechanics, which obey physical laws of a non-classical type, but real miracles that destroy the entire building of modern physical science, which has not happened until now.

Thus, while maintaining a materialistic position, we must recognize that, despite the fact that the same information data can be realized on different material carriers, in the final analysis, causal activity is inherent precisely in physical structures, and not in the ideal content of information.

Information causality exists only at the level of phenomenological description of self-organizing systems, while at the level of fundamental ontology the causal power of information data is reduced to the causal power of physical processes. Information has content, but not efficiency, because the physical system always operates, and the nature of its actions, as well as the configuration of its constituent elements, determines the content of information data.

It is correct to say not that information, being an ideal entity (if we understand by it the content of data, and not just a measure of the orderliness of material structures, i.e. not just a physical quantity equal to the difference between the maximum possible value of entropy and its value, which inherent in the system under consideration at a particular point in time) affects physical

objects, but that physical objects correlate with information data, the content of which allows making predictions about their physical behavior.

Compare, for example, a star and a living cell. Both of them are physical objects, but a living cell has a much finer and more complex structure than a star. Despite this, the behavior of a living cell is subject to the same physical laws as the behavior of a star, since, ultimately, both of them are composed of the same subatomic particles.

Therefore, it is correct to say not that the behavior of a living cell is determined, along with physical reasons, also by informational reasons, but that a living cell, having a more subtle and complex device than a star, correlates with more meaningful information found in the genetic code DNA.

But if informational causality does not exist, then mental causality does not exist either, because mental phenomena within the framework of the approach under consideration represent a form of information existence, and then consciousness turns into a “nomological loafer”, which contradicts the existential requirement accepted above.

To cope with this contradiction, first of all, we note that determinism in relation to the severity of the forecast being built can be classical or non-classical. Classical determinism assumes a strict causality of events of a physical order and physical parameters that describe the state of a material system.

Non-classical determinism assumes a strict causation of the probabilistic distribution of events of a physical order and physical parameters that describe the state of a material system. This type of determinism, as V.A. Fock, in his article “On the Interpretation of Quantum Mechanics”, takes root “in the probabilistic nature of the description, by virtue of which it is necessary to distinguish the potentially possible from the realized, in taking into account the relativity to the means of observation”, as well as “in the new understanding of the principle of causality, according to which this principle is directly refers to probabilities, i.e. to the potentially possible, and not to actually occurring events.

Classical determinism is inherent in classical physics, while non-classical determinism appears in non-classical (quantum) physics. Moreover, the statistical laws that operate in classical physics (for example, in thermodynamics) actually mean the presence of hidden parameters, the appeal to which turns statistical (probabilistic) laws into non-statistical (strict). But the probabilistic laws of quantum mechanics, as noted above, are not epistemological, but ontological in nature, and therefore they cannot be turned into strict laws of the classical type by any appeal to hidden parameters.

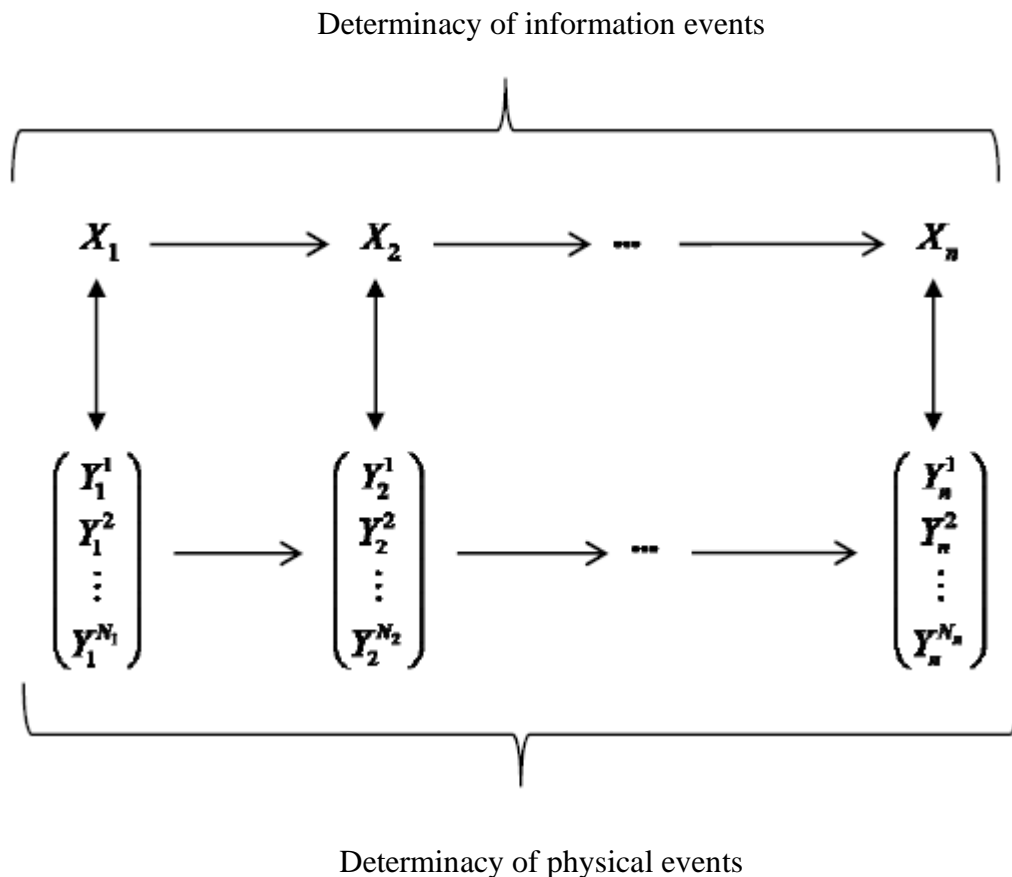
By virtue of the energy-information principle, according to which energy and information form a single material whole, the information event X_2 follows the information event X_1 only insofar as the physical event Y_1 , which is associated into a single material (energy-information) whole with the information event X_1 , the physical event Y_2 follows, which is associated into a single material (energy-informational) whole with the information event X_2 .

Therefore, it is correct to speak not about a causal relationship between two successive events of the information order X_1 and X_2 , but about their associative relationship, which is determined by the causal relationship between physical events Y_1 and Y_2 , correlating with X_1 and X_2 .

Due to the principle of supervenience, the correlation between informational and physical events within the framework of a single material (energy-informational) whole is ambiguous, since the same informational event can correlate with different physical events, while the same physical event can only correlate with one event. information order, which, as shown earlier, at the mental level of being provides the unity of the experiencing subject (which maintains identity in different physical states) and the possibility of intersubjective understanding (which allows two physically different subjects to be in the same intentional state).

Given the subject's physical state, we can draw strict inferences about his mental state, while given the subject's mental state, we can only draw probabilistic conclusions about his physical state. Let the information event X_1 be followed by the information event X_2 , and within the framework of a single material (energy-informational) whole, the set of physical events $Y_1^1, Y_1^2, \dots, Y_1^{N_1}$, forms a set of possible correlates of the information event X_1 , and the set of physical events $Y_2^1, Y_2^2, \dots, Y_2^{N_2}$, is the set of possible correlates of the informational event X_2 . Then, at the physical level of being, each element from the set of physical events $Y_1^1, Y_1^2, \dots, Y_1^{N_1}$ is a potential cause (with a certain probability) of each element from the set of physical events $Y_2^1, Y_2^2, Y_2^{N_2}$.

As a result, we come to non-classical determinism, which implies that the information correlates of physical events have a quantum-ontological character, i.e. exist within the framework of quantum ontology, but not classical.



Correlation between deterministic

sequences of informational and physical events

The causal chain of information events $X_1 \rightarrow X_2 \rightarrow \dots \rightarrow X_n$, being strictly defined, obeys classical determinism, while the chain of physical events correlating with it $Y_{1^1}, Y_{1^2}, \dots, Y_{1^{N_1}} \rightarrow Y_{2^1}, Y_{2^2}, \dots, Y_{2^{N_2}} \rightarrow \dots \rightarrow Y_{n^1}, Y_{n^2}, \dots, Y_{n^{N_n}}$, being probabilistically determined, obeys non-classical determinism. Therefore, the classical world, given in the perception of a conscious subject, is a purely informational world, where each object is a sensually perceived image, behind which lies a superposition of possible physical events.

In other words, the world itself is a set of superimposed possibilities, one of which is realized in the form of a sensually perceived reality.

The information event X_k correlates with the superposition of physical events $Y_{k^1}, Y_{k^2}, \dots, Y_{k^{N_k}}$, after the collapse of which (in the form of a single physical event Y_{k^1}) part of the information packed in Y_k is lost, and we pass from the quantum world to the classical one.

On the other hand, by virtue of the energy-informational principle, any physical being is an information code, and any information is encoded by a physical being. It follows that the space of information data is infinitely richer and more diverse than the space of physical objects, since the latter are divided into a large number of constituent structures, each of which has its own information data.

Within the framework of a physical system, many information layers coexist at the same time, connected by correlation relations with its physical subsystems. Thus, we can talk about informational superposition, which means that all informational correlations inherent in a physical system exist simultaneously as long as there are corresponding coding structures.

Sensory perception corresponds to a separate information layer of the surrounding world, which is included in the superposition of possible worlds that does not collapse until the moment when the representative information is not enough to separate the ontological alternatives that exist due to the energy-informational principle.

Each physical event Y_{k^1} is correlated with an information event X_{k^1} , of which the information event X_k is a part, i.e. $X_k \subseteq X_{k^1}$. Therefore, an information event X_{k^1} can be represented as a sum $X_{k^1} = X_k + X_{k^1}^*$, where $X_{k^1}^*$ is an information event belonging to X_{k^1} but not belonging to X_k .

Implementation of additional information (in the form of a certain physical event) belonging to the information event $X_{k^1}^*$ leads to the collapse of the set of superposed events $Y_{k^1}, Y_{k^2}, \dots, Y_{k^{N_k}}$, resulting in the realization of the physical event Y_{k^1} .

Thus, the attributive theory of information makes it possible to explain the collapse of the wave function, which cannot be explained from the point of view of physical laws, because, as M.B. Mensky in his article "The Concept of Consciousness in the Context of Quantum Mechanics", "von Neumann's reduction postulate is alien to quantum mechanics and is accepted in it (at the cost of eclecticism) only in order to quickly and easily bypass conceptual problems without solving them in essence, and go to practical calculations.

The above reasoning means that at the mental level of being depending on the interpretation of sensory data, we get different pictures of the world (more precisely, different observable worlds) Y^1, Y^2, \dots, Y^N , which are not compatible in the same linear sequence of events of a physical order, due to additional information data X^1, X^2, X^N . However, different observable worlds Y^1, Y^2, \dots, Y^N , have an intersecting area Y due to the existence of a common information space X , which is determined by the relations $X^1 = X + X^1$, where X^1 - information correlating with the observed world Y^1 in the absence of additional information data X^1 .

In particular, for $X^1 = \emptyset$ we have the equality $Y = Y^1$. Therefore, subjects belonging to the same physical reality can exist in different worlds not only symbolically, but also ontologically, i.e. act on the basis of different principles that describe the structure of the surrounding reality, and achieve practically significant results.

For example, the worldviews of a scientist and a shaman are radically different, but this does not prevent both of them, relying on different laws of being, due to different information data, which are interpreted by the subject, to perform actions that lead to the expected and predictable results in their worldview.

Moreover, the latter can be recorded both by the first and the second in the general reality, conditioned by the same information data, which correlate with different physical events. A Western doctor prescribes a medicine to the patient, which, within the framework of his picture of the world, stimulates the chemical and neurophysiological reactions in the patient's body, leading to recovery.

In contrast, the shaman, relying on a different picture of the world, with the help of the spirits that serve him, finds the lost soul of the patient and returns it to the physical body, after which recovery also occurs. At the same time, the fact of the patient's recovery is recorded in the general reality by both the Western doctor and the shaman, while the events contributing to this belong to different worlds, which are separated by the consciousness of the subjects under consideration.

In other words, additional informational data that constitute the mental experience of a Western doctor and a shaman lead to the formation of different sensually perceived worlds, but in a situation where the role of these data is insignificant, both the first and the second perceive the same classical reality.

This position is consistent with the cognitive pluralism of the American philosopher S. Horst, who, following I. Kant, believes that our representative pictures are determined by cognitive architecture, but, unlike I. Kant, does not ascribe to the latter an innate and rigidly fixed character, but allows its multiple realizability in accordance with the solution of individual problems. Cognitive pluralism allows for the existence of supernatural entities that turn out to be elements of a shared representational picture.

Therefore, the reality of a shaman coexists with the reality of a Western doctor as different information layers of a single physical world. Each information layer is associated with a particular representational capability.

The question of why we perceive the world exactly in the form in which we perceive it, M. Tegmark translates into the plane of natural science understanding and formulates it in the following form: why, of all possible solutions of quantum equations, we perceive precisely those solutions that correspond to our sense perception? In his article "Consciousness as a State of Matter," he writes: "One of the most striking features of our physical world is that we perceive it as a hierarchy of objects." And then he gives a good example with a glass of water and ice cubes floating in it. We perceive liquid water and solid cubes as independent things, although at a deep level they are interconnected with each other and represent a single energy whole.

Why, then, do we perceive the surrounding world as differentiated into separate objects, while we could perceive it as an integral plastic structure? The answer to this question within the framework of the quantum information model of consciousness comes down to the fact that mental experience is rooted in the quantum effects of non-local interaction of the brain with the entire surrounding world, as a result of which one of the superposed possibilities of unmanifested being is realized.

A similar point of view on the nature of mental experience is shared by V.V. Vasiliev, who, within the framework of local interactionism, recognizes the global supervenience of consciousness, which believes that two physically identical universes cannot have different mental states, but denies its local supervenience, assuming that two physically identical neural systems may have different mental states in the same same physical universe.

Developing his philosophical position, V.V. Vasiliev, ultimately, comes to the theory of the panprotopsyche type, for "private mental states are necessary ontological conditions for the realization of non-local physical causality."

After all, non-local physical causality is observed at all levels of physical existence, including at the level of interaction of elementary particles, and, therefore, some mental states must already be inherent in elementary particles that are in a quantum-entangled state.

However, there is a logical possibility that reconciles the theory of local interactionism, which denies the local supervenience of consciousness, with quantum information theory, which, on the contrary, recognizes the local supervenience of consciousness, i.e. believes that two physically identical neural systems cannot have different mental states, just as two computers that are in the same physical and, therefore, functional states (because the latter are determined by causal relationships between the physical substructures of the material system under consideration) cannot perform various computational operations.

Such a logical possibility lies in the fact that quantum information theory necessarily requires only local supervenience of unconscious mental material, while the mental (conscious) phenomena built on top of it retain their variability due to the fact that they are the result of the collapse of the totality of unconscious potential mental states.

In other words, different mental (conscious) phenomena can correspond to the same distribution of unconscious potential mental states, since the decoration of the former has different possible executions. As a result, we come to the conclusion that different mental (conscious) phenomena can be inherent in neural systems that are in the same physical and, therefore, functional state, which is consistent with the theory of local interactionism.

However, unlike the theory of V.V. Vasiliev, these arguments allow not only a violation of the local supervenience of consciousness, but also the global one, because in two physically identical universes not only can, but there must be different consciousnesses, which is explained by the fact that, as noted above, each consciousness is unique and not identical to another for the account contained in it of the moment of self-consciousness of oneself in its phenomenal content as precisely oneself, and not someone else.

Then a logical question arises: what exactly determines the probability of this or that event within the framework of non-classical determinism, and are there any reasons explaining why one of the superposed possibilities is actually realized, while others disappear without a trace? In order to answer the question posed, we distinguish two types of causality in relation to the nature of the causal relationships between cause and effect - longitudinal and transverse.

Longitudinal causality causes a linear sequence of physical events, when the past physical event acts as a cause, and the future as a consequence in relation to a physical event occurring at the present moment in time. Transverse causality determines the choice of a single option from a set of superposed possibilities, when the quantum world passes into the classical one and part of the information about the previous state of the physical system is lost.

Longitudinal causality (classical or non-classical) is of a physical nature and is described by the equations of physical science. In contrast, transverse causality has no physical character and is not described by the equations of physical science, since if a quantum event Y_k^1 , (which corresponds to the probability p_k^1 from the set of superposed possibilities $Y_k^1, Y_k^2, \dots, Y_k^{N_k}$ (moreover, the probability p_k^1 can take the smallest value), then no laws of physics can explain why the event Y_k^1 happened, and not any other from the set of superposed possibilities $Y_k^1, Y_k^2, \dots, Y_k^{N_k}$.

Consequently, the reason for the collapse of the superposition of possible states is not physical, but informational in nature, which does not allow the existence of hidden parameters that could be used to reduce non-classical determinism to classical.

Thus, it is possible to draw a line of demarcation between quantum informational correlativity and determinism, as well as between quantum informational correlativity and parallelism. In the case of determinism mental phenomena are generated by neural processes occurring in human brain, and the presence of the latter necessarily entails the presence of the former, while in the case of quantum information correlativity such a necessary connection does not exist, and from the presence of the latter with the necessity the former does not follow in the sense that, without violating any physical laws, one can conceive the existence of unconscious zombies.

The relationship between energy and information is not physical, but metaphysical, and is determined not a priori, but a posteriori as a fact of the existence of a material being. On the other hand, parallelism implies the absence of any mutual conditioning of physical and mental processes that run in parallel and do not exert any causal influence on each other.

In contrast, quantum information correlativity suggests the presence of mutual conditionality of physical and mental processes, since, firstly, information states are determined by physical states of a material being, being information about its mass, charge energy, etc., and, secondly,

physical states are determined by information states of a material being due to the action of transverse information causality.

Thank you.

To be continued...