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Properties of Neutrality and Its Importance for Maintaining Biodiversity and Stability of Systems

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Abstract
There is a category of terms that do not have a strict scientific formulation. These include the term "neutrality". Previous researchers used it in relation to each specific situation, including for objects that may have nothing in common with each other. With this approach, each specific case has its own neutrality, different from others, which does not contribute to the development of a scientific definition of the term. Analysis of numerous data leads to the understanding that the definition must be given from the perspective of probability theory. There are two types of neutrality – the first and second kind. The need for the precise definition of the term and clarification of the properties of neutrality are due to the universality of the phenomenon of neutralism; without taking it into account, the characteristics of the evolutionary process cannot be complete.

Keywords: Evolution, Neutralism, Probability Theory, Biodiversity, Variability, Mutations, Genetics, Quantum Theory

1. Introduction

Some phenomena constantly accompany us in our daily lives, and we get so used to them that we do not give them due importance. Probably for this reason, many terms do not have a strict scientific definition, something the author had to repeatedly encounter in the process of scientific research. One of these terms is "neutrality". Everyone puts their own understanding into this term, and before the work of the author [1], there was no strict scientific definition of the term.

The word "neutral" is most often used in everyday life. It is used to mean "indifferent," that is, not involved in anything. For example, in the dictionary of Ozhegov [2, p. 347] "neutral" is: 1 – not adjacent to any of the fighting parties, standing aside; 2 – does not give either an alkaline or an acidic reaction; 3 – has neither harmful nor beneficial effects. Accordingly, the noun "neutrality" is "non-interference in a war occurring between other states".

It is quite obvious that the above examples do not exhaust the variety of situations that fall under the definition of "neutral". In addition, a concept becomes scientific only when the definition is valid for a certain set and does not depend on the individual properties of its components. That is, Ozhegov's definition cannot be considered scientific; he only deciphers the meaning of the word "neutral" using some several examples. With this approach, which is generally accepted, neutrality in each individual case is its own, different from other neutralities and suitable only for the specific situation.

The term "neutral" is used in various branches of knowledge (biology, chemistry, genetics, mathematics, cosmology, etc.), and few people think about the fact that a person is constantly faced with neutrality in his everyday life. Neutrality is a state that precedes choice, and as scientists have calculated, the person makes his choice several thousand times a day.

The purpose of the work is to bring fundamental information to a wider range of researchers, since initially our data were published in a local institute collection, and also to show the universality of the phenomenon of neutralism, for which new examples are used and sections are added, including a section on the manifestation of neutralism at the quantum level. Below is a definition of neutrality, examples are given and the meaning of neutralism as the universal phenomenon is revealed; its role in the evolutionary process is shown.

2. Methodological Grounds

As mentioned above, a concept becomes scientific when it is valid for a group of objects, that is, it reflects something common, inherent in them, and does not depend on the many individual characteristics of each object. When considering certain properties of objects by different researchers, a subjective approach will dominate, since preference will be given to those properties of the object that seem to the researcher to be the most important at the moment or in connection with the specifics of the field of study. Finding something common that would be inherent in the group of objects involves abstracting from a complex of individual characteristics, thereby requiring the formal approach to solving the problem, therefore in this case, as in many others, we used the formalization method.

3. Definition of Neutrality

Evolution is understood as a synonym for development, and when considering it, the main attention is paid to processes of a mobile character. However, changes are usually preceded by a state of some staticity, and the short duration of these states does not reduce the importance of their study, because without taking them into account, the characteristics of the evolutionary process cannot be considered complete and comprehensive. We are not talking about long periods of stasis in speciation in this work, because not only living systems evolve. Here we are talking about short-term states of living and non-living systems, which can change at any moment due to internal reasons or external circumstances `and which relate to the behavior of systems at separate points in time.

The concept of neutrality belongs to the category of probabilistic ones, as can be seen from the examples above. Some static state (non-alignment with any of the warring parties; remaining indifferent to alkalinity, acidity, usefulness or harmfulness of properties or characteristics) can change at any time due to changing circumstances and is therefore only temporary. Based on this, we have given the following definition of neutrality.

Neutrality *is a state of an object when several potential events that are the result of a change in this state have equal probabilities of happening for the object, or the state of a group (system) of similar and interconnected objects when one event has an equal chance of happening for each of them* [1]. In the case where we are dealing with the single object, we will speak of neutrality of the first kind; and we are dealing with neutrality of the second kind when we are talking about the group of objects, for each of which the probability of the certain event occurring is the same.

The differences between neutrality of the first and second kind are clearly visible from Figure 1.

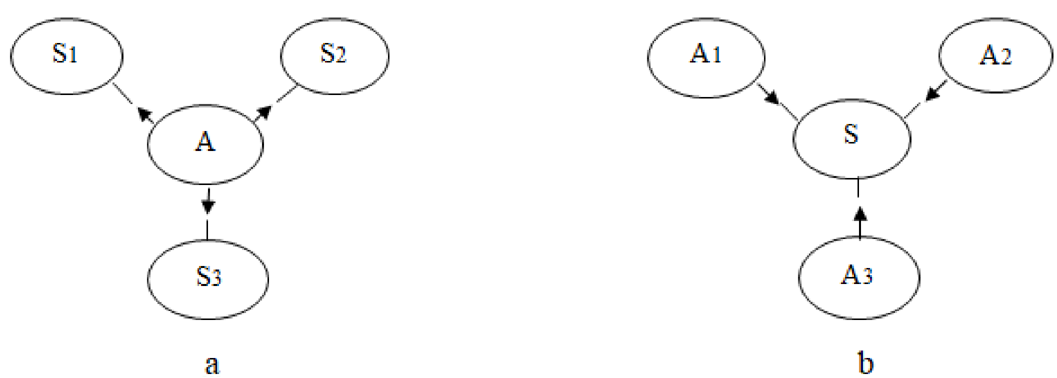


Figure 1: Schematic Representation of The Neutral State of Systems Demonstrating: a – Neutrality of The First Kind (a – object; S1, S2, etc. – potential equally probable events); b – Neutrality of The Second Kind (s – An Event That Is Equally Probable for A Group of Similar and Interconnected Objects A1, A2, etc.).

The manifestation of neutralities of various kinds is called *neutralism*. Other researchers may put their own meaning into the concept of neutralism (depending on the field of study); here we give a definition of neutralism from the positions outlined above. In our previous work [1], we wrote about neutralism of the first and second kind, but it still seems more correct to talk about neutrality of the first and second kind, and use "neutralism" as the general concept.

Let us recall that in classical probability theory an event is any fact (phenomenon) that may or may not occur under given conditions [3]. In this case, the result of an action (possible or impossible) is considered as event, and the action itself is called a test. A shot or coin toss is the test, that is, the conditions in which events take place, while hitting (or not hitting) a target or the appearance of a coat of arms (numbers) is the event. Probability theory thus operates with the final results of possible actions. Since neutrality is a temporary state and can change at any moment, it can be described in terms of probability theory.

4. Neutrality of The First Kind

Neutrality of the first kind is characterized by the number of equally probable events possible for an object. A violation of the neutral state may be associated with a change in the properties of the object itself and/or the properties of the environment, that is, with the start of testing. For example, water can equally likely turn into steam (if it is heated) or into ice (if it is cooled). Events that can occur in relation to one object and reflect the change in its state are, in the terminology of probability theory, inconsistent [3]. They cannot happen simultaneously: the implementation of one event blocks the implementation of other events. You cannot heat and cool water at the same time. Another example: a person can choose several potential cities for a trip, but he cannot go to all these cities at once, at the same time, since movement towards one of the points excludes movement along other trajectories. When a player rolls a die (test), the probability of the event occurring, which before rolling (that is, before the start of the test) was equal to 1/6, now becomes equal to 1, while the probability of the remaining (incompatible) events occurring at the time of the test becomes equal to 0. Obviously, when throwing the die, one of the six sides will fall out, and all 6 sides cannot fall out at the same time.

The initial moment of any development is characterized by the equal probability (equality) of many possible development paths. This applies not only to biological taxa, but also to other systems, for example, to civilizations: movement along one of the development paths blocks movement along other routes. The change in socio-economic formations was not carried out due to the desires of individual groups or individuals, but occurred due to the increase in internal contradictions and conflicts and was a necessary condition for further existence.

In 1968, Kimura Motoo put forward his theory of the neutrality of molecular evolution. According to his ideas [4], evolutionary changes and intraspecific genetic variability at the molecular level are caused mainly not by Darwinian selection, but by random drift of mutant alleles that are selectively neutral or almost neutral. Random genetic drift refers to the random fluctuation of gene frequencies in a population caused by the random selection of gametes during the process of population reproduction. Neutrality is manifested here in the fact that any selectively neutral mutation can in the future become either harmful or beneficial, or remain neutral with equal probability (neutrality of the first kind). Kimura points out that “neutral alleles” under appropriate environmental conditions or in a different genetic background can become favorable and thus neutral mutations have a latent potential for responsiveness to selection.

Processes of variability are subject to the properties of neutrality of the first kind: a change in species in one direction blocks the possibility of change in other directions (often this is facilitated by the direction of changes in the external environment).

The American biologist Lipton found that cells are characterized by two main types of reactions to environmental stimuli – protection and development. These mechanisms function in turn: cells in a state of protection do not develop [5]. Thus, neutrality of the first kind also manifests itself at the cellular level; what the cell’s further tactics will be depends on the totality of external conditions.

Neutrality of the first kind has the property that with a sufficiently large number of tests, all equally possible events, all options are realized.

5. Neutrality of The Second Kind

Neutrality of the second kind, which consists in the same probability of the occurrence of one event for a group of similar and interconnected objects, acts in the opposite way. For example, if 10 countries are involved in a conflict, then the probability for any of them to become a partner with the rest of the countries is, in principle, the same and equal to 1/9. These countries fall under the definition of “objects of the same type,” which excludes their absolute identity with each other, but allows for differences in certain parameters (strong or weak partner, adjacent or remote territory, common religion, etc.). Any of the properties of objects, as well as external reasons (politics of war or peace) can be decisive when choosing the partner. We are talking about objects of the same type not only because here, as in all other cases, “compares comparable,” but also because in life there are practically no absolutely identical objects that arose naturally as a result of development. Neutralism, acting as a generalizing category, at the same time reflects the connections between real objects and phenomena that actually exist in nature, therefore it is not something far-fetched; it characterizes the state of systems in certain periods of their development.

Another example of neutrality of the second kind can be the arbitrariness of recombination variability, associated with the fact that any of the chromosomes can be drawn into the recombination process with equal probability. Geneticists write that “when the members of each pair of chromosomes separate at the end of the first meiotic division, nothing causes all the paternal (or maternal) chromosomes to move together to the same pole. Each pair of chromosomes diverges at the poles independently of the other pairs. Any haploid cell... can contain arbitrary recombination of parental chromosomes” [6, p. 29]. The arbitrary set of gene frequencies in any population and the random nature of their distribution are the reason that any combination of genes and fluctuations in their frequencies can be involved with equal probability in the process of evolution.

Out of 200 million human sperm, only one breaks through the membrane and penetrates the female reproductive cell, although theoretically any of the sperm has an equal chance of penetration.

The occurrence of an event that is equally probable for a group of objects may not depend on the entire complex of properties of objects, but only on some part of them, which may come to the fore when the event is realized, therefore both the internal state of objects and external (supra-system) causes are important. The selectivity of the action of external factors can be seen in the example of today’s events. Every 12 and 24 thousand years (according to [7] – 13 and 26 thousand years) the Solar system is exposed to hard cosmic radiation of an unknown nature, heating the cores of planets and satellites due to their high density and high conductivity compared to other shells. But, since the core synchronizes and stabilizes all geodynamic processes, destabilization of the core entails many negative consequences.

Another example of the selective action of an external factor is the negative effect of the dye root (*Lachnanthes*) on individuals with white coloration mentioned by Darwin [8]. It turned out that the eaten roots stain the pigs' bones pink and all of them lose their hooves except the black varieties. Farmers selected black piglets from each litter for rearing, resulting in all adult pigs in Virginia being black. Need I say that genetic diversity is preserved?

An event that can take place in relation to a group of interconnected objects can occur both for all objects at once, and for part of them, that is, be extended over time (for example, the mass extinction event in paleontology).

6. Phenotype Leveling Effect

The effect of phenotypic equalization refers to the smoothing of phenotypic differences, which can occur under the influence of certain conditions, most often stressful ones [1]. In particular, this was observed in experiments with warm-blooded animals. When mice were kept together in large communities (50-60 individuals in one large bath), over time they became similar to each other and began to react in the same way to external stimuli [9]. It can be assumed that the newly formed population, under conditions of unusual housing and increased numbers of animals, experienced a certain stress, as a result it began to react as an integral functional system.

At one time, one correspondent visited the African tribe from which the great-grandfather of the famous Russian poet A.S. Pushkin came, and was struck by the external similarity between the members of the tribe; according to him, they "are all Pushkins." Due to the age of publication, we are not able to refer to the newspaper in which this case was covered, but the fact itself certainly deserves attention. In nature, the effect of phenotype equalization in human populations manifests itself quite widely. This can be evidenced, for example, by the difference between different races. It is difficult to confuse a representative of the Europeoid race with representatives of the Mongoloid, Negroid or other races.

Very interesting data were obtained when studying the influence of thermal selection on the structure of populations of cold-blooded animals. When analyzing the responses of individuals of cold-blooded animals (frogs, salamanders, etc.) to changes in temperature, Ushakov and his colleagues established a negative correlation between the initial level of resistance of the organism and the change in this level as a result of thermal acclimation [10]. Thus, it turned out that when the temperature increased, families with high initial resistance to heat practically did not change it, and the increase in heat resistance of the population as a whole occurred at the expense of animals with minimal heat resistance. With a decrease in temperature, on the contrary, the most dramatic decrease in heat resistance was observed in individuals with increased heat resistance to high temperatures. The increase in the heat resistance of organisms with increasing temperature and its decrease at low temperatures was thus carried out at the expense of different individuals of the population. As the result, there was a narrowing of the amplitude of individual variability and a reactive smoothing of differences at the population level, that is, phenotypic leveling of differences at maintaining genetic heterogeneity. Phenotypic masking of genotypic differences led to the decrease in the genetic efficiency of selection. If elimination nevertheless occurred, it was indiscriminate, and when the adverse effects ceased, the population structure was restored. In relation to thermal selection of the population, neutrality of the second kind thus occurs.

The effect of phenotypic alignment can also be recorded on paleontological material. At the beginning of the Devonian, among representatives of different orders of corals (the Tabulata, Rugosa and Heliolitida), forms with unusually strongly thickened corallite walls appeared. Previously, this fact did not have a proper explanation, but in light of the above, we can assume that in this case we are dealing with the manifestation of the effect of phenotypic equalization, which led to a weakening of the action of natural selection, which had a similar effect on different groups of corals. At the same time, the genotypic diversity of corals was preserved, since a certain characteristic (the thickness of the corallite walls) was subject to change. The probable reason for the thickening of the walls was the change in the salt composition of the water.

The appearance in certain periods of Paleozoic time (Silurian, Devonian) of a very large number of genera of branched tabulates can also be considered as a result of the alignment of phenotypes, which was carried out under the control of the external environment. As a rule, branched forms arise with insignificant hydrodynamic activity (increasing depth of habitat or lagoon conditions). When distinguishing such genera from each other, not only the external appearance is taken into account, but mainly the internal structure and the relationship of characters with each other.

The effect of phenotype equalization can be observed in crisis conditions of life development. Dobrolyubova traced how, with the deterioration of living conditions in the Oka-Serpukhov time (Early Carboniferous of the Russian Platform), the structure of the Lower Carboniferous genus *Dibunophyllum* (species *D. bipartitum*) was simplified and transformed into the genus *Caninia* (species *C. okensis*) [11]. The restoration of the diaphragmatophore structure due to deterioration of environmental conditions was also observed by Voinovsky-Krieger [12]. He wrote about the emergence in the ontogeny of the Early Carboniferous Rugosa of the Urals *Cyathoclisia coniseptum* (Keys.) of the *Caninia* type structure. Due to the fact that forms with the structure similar to *Caninia* are found at different stratigraphic levels, their exact systematic position is not always determined, and specialists often put the name of the genus in quotation marks. According to researchers [13], corals with the *Caninia* type structure were widespread in carbonate shallow-water facies of the Carboniferous and Early Permian, so phylogenetic relationships within this group are mostly unclear due to the similarity of their adult stages.

The appearance of the Rugosa is associated with the Middle Ordovician. The most ancient and primitively constructed were the diaphragmatophore forms [14]. A common feature of all Middle Ordovician rugoses (North America, Baltoscandia, Australia, Siberian Platform, and Central Asia) is the absence of dissepimentarium [15]. Facts indicate that new structures developed under favorable conditions, which was expressed not only in the development of dissepiments and various axial structures, but also in the transition to a colonial way of life [16]. "...the more favorable the conditions, the more diverse the composition of the complex in general and the higher the percentage of colonial forms" [15, p. 7]. The restoration of diaphragmatophorness (horizontal or close to horizontal structure of the bottoms), as in the case of *Caninia* discussed above, acts as recapitulation [16]. Therefore, it should be borne in mind that the primitive structure, which is quite clearly manifested during periods of crisis, does not always prove the survival of unspecialized forms, but may be evidence of a secondary simplification of morphology.

Why can simplification of the structure occur at all? The tactics of cell behavior established by Lipton [5] are also fully applicable to whole organisms. When external conditions deteriorate, defense tactics come first in organisms, and the mobilization of energy potential, which is limited to a certain framework, can be expressed not only in blocking development, but also in removing the later evolutionary stages of development. Accordingly, the morphotype of more ancient forms is restored. Researchers believe [17] that the adaptive capabilities and mechanisms of organisms and entire populations can be studied in cells.

The difference in the influence of the same environmental factor on different phenotypes is clearly seen from the example of black and white pigs. The essence of the phenotypic equalization effect is to make elimination indiscriminate, thereby preserving genetic diversity. An increase in the number of individuals of the same type, expressed in the leveling of characteristics, means that any of them can be subject to selection with equal probability (neutrality of the second kind), but genetic diversity is preserved – both due to the uniqueness of each individual, and due to the fact that only separate characteristics (but not all) are subject to selection.

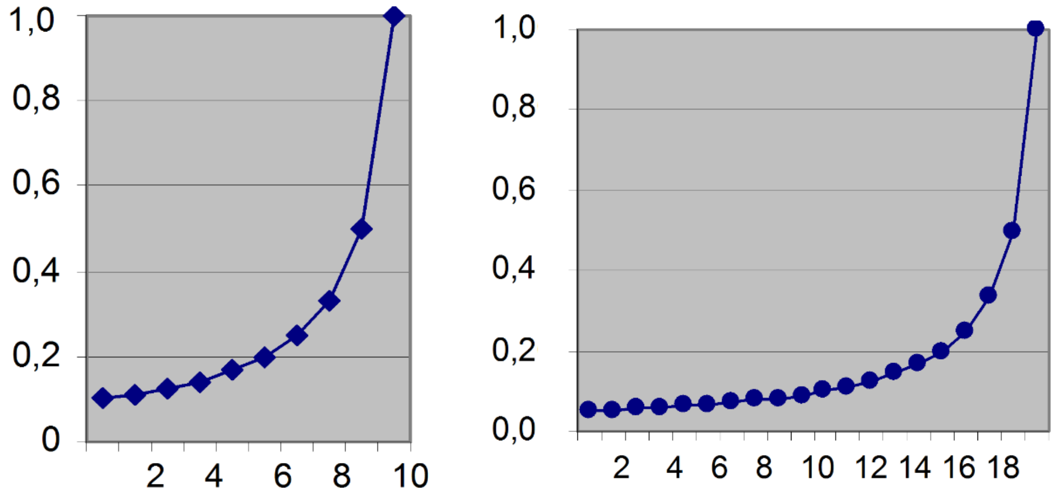
7. Neutrality as One of The Ways to Maintain System Stability

Neutrality thus opens up possibilities for maintaining diversity in nature. Neutrality of the first kind has the property that with a sufficiently large number of tests, all equally possible events, all options are realized, that is, the number of different situations increases. The essence of neutrality of the second kind is that during testing, certain properties of objects usually come to the fore, while other properties remain largely unchanged, acting as "secondary" and not subject to such strong pressure. The situation is similar to that which arises when removing multi-colored objects from an urn, when their color is taken into account, but not their shape, composition or size, which allows the objects (if they are not completely destroyed) to one degree or another to retain their properties, that is, to maintain diversity.

The study of neutrality allows us to more fully understand other aspects of the evolutionary process. Let's consider the situation, which is similar to a dice game. The probability of an event (that is, getting one of the 6 points options) is 1/6. The neutral situation is maintained until the start of the test. But when one of the players throws a die (test), the situation changes sharply, the probability of the event occurring (that is, that as a result of throwing one of the six possible states of the object is realized) becomes equal to 1, while the probability of the occurrence of other (incompatible) events becomes equal to 0, since all 6 faces cannot fall out at the same time.

Let us now assume that the repetition of any realized event is automatically excluded from further play. Then, after the end of the throwing, the neutral situation is restored, but with a different probability of the event occurring, equal to 1/5, 1/4, etc. It is not difficult to see that in such a sequential chain of tests and events the situation will repeat itself, and the system will move from a static state at the moment of neutrality to the dynamic state at the subsequent moment when neutrality is violated. It is also obvious that events occur with increasing probability and that with a larger number of equally possible events or with the larger number of objects of the same type for which one event occurs, the full cycle of system activity will end after a longer period of time.

Let's build a graph of the extinction of two populations with a smaller (10) and larger (20) number of objects (Figure 2) to demonstrate what was said.



a b

Figure 2: Graphs of Sequential Extinction Of 10 (A) and 20 (B) Individuals (Families) of Two Populations (The X-Axis Is the Number of Individuals, The Ordinate Is the Probability of Extinction).

It does not matter whether each object is represented by one individual or a family – a structural unit of a population that is distinguished by greater genetic homogeneity from other similar structural units and therefore has approximately equal chances of extinction (or survival) for all its members.

The graphs show that with a larger number of individuals or families, a population has a greater chance of surviving longer. The more objects there are, the slower the steepness of the curve increases. In the last section (after a probability equal to 1/2), the curve segment takes on the character of a straight line. This structure of the last segment is the same for any number of objects, that is, it does not depend on the initial total number of objects, and indicates the channelization of the process. This makes it clear that small populations, as a rule, are doomed to extinction [18]. There is the certain limiting minimum number of individuals in the population (inseparable from the totality of its genetic properties), below which the extinction of individuals takes on the character of the canalized process. After observing populations in natural conditions, researchers came to the conclusion that for the normal functioning of the population the certain number of its constituent individuals is necessary, and the concept of a minimum population size was introduced into ecology, that is such size, at which the population is able to fully reproduce and survive.

We have previously shown [19] that repeatability in nature acts as a natural consequence of naturally occurring processes and is a necessary condition for maintaining the stability of systems. A definition of stability was given (stability is the ability of matter to extend itself over time) and three types were identified – statistical, systemic and sinusoidal. It was noted that statistical stability is based on the fact that with a large number of objects, there is a greater probability of preserving at least some of them under adverse influences. An increase in statistical stability (manifested in the increase in the number of objects of the same type – from individuals and populations to planets and galaxies) increases the system's chances of survival and prolongation of existence under the influence of unfavorable factors. Adverse factors, as a rule, do not immediately affect the entire cluster of objects, but have a local impact, therefore, the greater the number of objects, the higher the probability of preserving at least some of them.

In the light of the Principle of multiple repetitions established by us [19], the phenotypic smoothing of differences between individuals in populations appears as an increase in its statistical stability. The population strategy, under conditions of increasing selection pressure, is aimed at narrowing the range of phenotypic variability and thereby increasing its statistical stability: increasing the number of objects of the same type (increasing neutrality) and, as a consequence, decreasing the probability of elimination for any individual object. The curves on the graph (Figure 2) clearly demonstrate the essence of statistical stability: the greater the number of objects exposed to adverse effects, the less likely it is to occur for the single object and the more time it will take for their complete destruction (destruction of the system). As stated above, in nature there are rare cases when an adverse impact leads to the destruction of the very large number of objects of the same type at the same time. This is partly due to the fact that the probability of destruction can change over time (for example, due to adaptation to impacts), partly due to the fact that there are certain (individual) differences between objects of the same type. Neutrality, thus, acts not only as a factor in maintaining diversity, but also as the factor in maintaining the stability of systems. It is obvious, for example, that the presence of the large number of selectively neutral mutations and the random nature of genetic drift significantly lengthen (stabilize) evolution and prevent its rapid completion.

8. Neutrality in Quantum Theory

From the above examples one can see that neutralism is widely manifested both in the world of biological beings and in the ordinary world, at the level of macro-objects and at the nanoscale level (the size of genes and chromosomes). It also operates at the level of elementary particles, which are the subject of study of quantum theory. For example, there is a known phenomenon in physics called quantum-wave duality, when photons and electrons, depending on the experimental conditions, will exhibit either the properties of particles or the properties of the wave. That is, for each of them two potential states are possible, which corresponds to neutrality of the first kind.

It should be noted that currently scientists tend to extend the laws of quantum physics to macro-objects. According to this view, quantum theory is a description in terms of the states of any objects, regardless of whether they are large or small. With equal success, the methods of quantum theory can be applied both to microparticles and to the entire Universe as a whole [20]. The quantum approach involves considering a selected system as the single whole, within which certain properties of the parts can manifest themselves. In this case, the theory operates with such concepts as quantum entanglement, decoherence and coherence, and inseparability.

An entangled state is the state of a composite system that cannot be divided into separate, completely substantive and independent parts [20]. Quantum entanglement occurs in the system consisting of two or more interacting subsystems, and it is a superposition of macroscopically distinguishable states. If the system was initially in the nonlocal superposition state, then its constituent parts, like local classical objects, do not exist until decoherence occurs. Entanglement, thus, acts as a special form of interaction between objects, leading to the emergence of the special state when the properties between these objects become indistinguishable.

Decoherence is a physical process in which the non-locality of a system is violated and the entanglement between the component parts of the system is decreased as a result of its interaction with the environment. In this case, the subsystems “manifest” from a non-local state in the form of separate independent elements of reality; they become isolated, separated from each other, acquiring visible local forms [20]. The amount of entanglement depends on the intensity of interaction and varies from 0 to 1. If the system is a single inseparable whole, then the measure of entanglement is 1.

Coherence is the reverse process of decoherence, that is, the process of entangling subsystems with each other to form a single system due to a decrease in the interaction of subsystems with their environment. For the system in an entangled state, there are several equally probable events: the state of maintaining coherence; partial decoherence; complete decoherence. This means that it is characterized by neutrality of the first kind. For the subsystems of the system, there is an equal probability of going into the state of decoherence, that is, of “manifesting.” It is equal to 1/n, where the number “n” is the number of subsystems of the system. Consequently, they are characterized by neutrality of the second kind.

Inseparability is the impossibility of dividing a system into separate free and completely independent components. This is a non-local state, and then there are no classical, “visible” objects in the system (even at subtle levels of reality) [20]. The concept of inseparability (synonymous with quantum entanglement) came to us from the world of elementary particles, but was then extended to macro-objects.

Thus, both neutrality and entanglement have a common property – uncertainty. Until the state of neutrality or entanglement is broken, we cannot know about the path of further development (or about the further development of events). Entanglement levels the properties of objects (subsystems of the system), and before their manifestation we cannot say anything about them. We note the presence of entanglement, but at the same time the personal properties of individual components recede into the background. The state of objects of quantum physics, like any other objects, does not remain constant; it can change at any moment, which means that the properties of neutralism apply to them in the same way as to any other objects. The probability of change in both cases is the same and varies from 0 to 1. Neutrality, having, like entanglement, the property of uncertainty, at the same time is not entanglement. Neutrality is the state of equal opportunities, but the individual properties of objects are not only preserved, but often come to the fore when making a choice.

Indirect indications that neutrality also operates at the quantum level can be seen from the following statement: “The pair of good/bad states can be considered as an analogue of the two classical states |0> and |1>. Within the framework of quantum theory, a superposition of these states begins to work, and it is possible, for example, the most entangled state “neither good nor bad,” that is, “nohow” [20, p. 198]. The state of “neither good nor bad” corresponds to the state of neutrality in the generally accepted (that is, before giving this term a scientific definition) understanding.

It is believed that the Universe as a system (in relation to the external Observer) is in the most entangled state (entanglement measure = 1), but in this case it, like any other system, must have the “right to choose” – to remain in the entangled state or decohere. At the moment, our statement is nothing more than a theoretical assumption, but who can be sure that he knows everything about the Universe?

9. Choice and Inevitability

From the plotted graphs (Figure 2) it is clear that at some stage the process of elimination of individuals is canalized, and if an unfavorable factor acts with the same intensity, the process of extinction becomes inevitable. It is also clear from the graphs that with a smaller population size, the elimination process proceeds faster. If the population consists of 10 individuals, then the probability of being negatively affected by the external factor (the relative equality of the morphophysiological parameters of individuals is implied) is 0.1. If the population size reaches 100 individuals, then each individual has a chance of longer existence, since the probability decreases to 0.01. If the effect of the unfavorable factor is not critical (not aimed at destroying the population), then, as a rule, single characters are subject to selection pressure, as could be seen from the examples given above. From this it is clear that polymorphism is beneficial to the species: the wider the range of variability, the more time it will take to "test" a set of traits.

We noted above that with a large number of tests, all events that correspond to neutrality of the first kind have a chance of occurring. Being incompatible, they cannot occur simultaneously, but the length of time guarantees the implementation of each of them. It should be noted that in nature, any events are probabilistic. Events with a higher probability occur more often than events with the lesser probability, but if there is even the tiny probability for some rare event, then with the sufficiently large number of trials it will certainly come true. This should be kept in mind when we, for example, encounter abnormal behavior of people (sadism, excessive aggression, cannibalism); we wonder how this is possible in principle. It is possible to exclude anomalous phenomena only by reducing the probability of their occurrence to zero.

Probability has the property of changing over time, that is, events with the high probability of occurrence for one reason or another may decrease their probability over time. Therefore, there is an element of uncertainty in predicting events of various kinds. Seers whose predictions come true 70-80% are very good seers. The question arises: in what cases is the implementation of events inevitable?

Some of the options were shown above: 1 – with a large number of tests, even events with low probability occur; 2 – when a process becomes channelized, sometimes it is impossible to pause it. Another option is when the occurrence of one event depends on the occurrence of several other events, as shown in Figure 3.

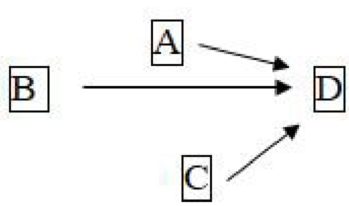


Figure 3: The Occurrence of Event D Depends on The Probabilities of Occurrence of Events A, B and C

As each of the events (A, B and C), which have their own probability of occurrence, occurs, the probability of event D occurring increases, but when they all occur, then the occurrence of event D becomes inevitable. Thus, we define inevitability as the absence of choice.

10. Conclusion

Despite the relative short duration of states of neutrality, their study and ascertaining are of great importance. The wide occurrence of neutralities in life and in nature forces us to consider them under the general name of neutralism as a universally existing phenomenon. Its role in the evolutionary process also becomes clear. By equalizing the chances, that is, the probabilities of different events, neutralism sets in motion the mechanism of non-selectivity, and some forms can be replaced by others, some formations can be replaced by other formations, etc. In the case where there is an effect of phenotype equalization, an increase in statistical stability is associated with the state of neutrality. In addition, non-selectivity of selection for certain traits contributes to the conservation of biodiversity as a whole. The random nature of recombination variability is, according to the general opinion of scientists, the cause of genotypic (ultimately, phenotypic) diversity.

In the literature, there is evidence of a narrowing of phenotypic variability at different levels – tribe, population, or at the level of related taxa. They appear as isolated random phenomena, so their significance has not been properly appreciated. Analysis of data on modern and fossil organisms indicates a widespread manifestation of the Phenotype Leveling Effect in nature and thus the independence of the phenomenon and the importance of its study. It complements our understanding of the mechanisms of action of Natural Selection in natural populations. Properties of neutrality of the second kind allow us to conclude that polymorphism is beneficial to the species, as different traits may experience different selection pressures, which generally contributes to the conservation of biodiversity.

It is believed that in nature natural selection acts discriminatory, supporting the most successful, highly adaptive forms. Based on the statement of the effect of equalization of phenotypes, we can conclude that selection does not always support highly adaptive forms, but can equalize the chances of forms with different genetic inclinations or with different reactive abilities. Equal probability creates equal prerequisites for choosing any direction of development or for the implementation of a number of events. At the same time, certain properties of objects may come to the fore, while others remain unclaimed or in little demand.

It is known that during biological crises mutants can become widespread. One of the reasons may be that in moments of crisis, when the state of neutrality increases, the chances of the implementation of hidden mutations may increase, because, as a rule, certain single characteristics are subject to selection. The study of the properties of neutrality shows that the reason for the appearance of mutants can be not only the "loosening" of the hereditary basis, but also the indiscriminate selection for most traits, as a result of which the likelihood of mutant states increases. This is the same as if you exclude the appearance of even numbers when throwing a dice (which is equivalent to narrowing the range of variability), and then the probability of the appearance of odd numbers (the same mutants) will increase from 1/6 to 1/3, that is, twice. The increase in the frequency of mutations during crises may therefore have a purely mechanical nature, due to selective neutrality. Deterioration of environmental conditions often strengthens neutralism, which increases the chances of survival, including mutant forms.

Neutralism, as a manifestation of various kinds of neutralities, acts equally at all levels of reality. The universality of the phenomenon of neutralism indicates that it cannot be ignored. Being universal, neutralism acts in practice as an integral property of any evolutionary process, as one of the stages of the cyclic development of biological and other systems. The wide spreading of neutrality and the strict scientific formulation of the term transfer it from the category of everyday concepts to the category of fundamental concepts. Neutrality is a state that precedes choice. The choice can be either conscious or imposed by external conditions and circumstances. In relation to an object, the equality of external and internal acts as one of the manifestations of symmetry. The very state of neutrality, characterized by the equal probability of events that can occur as a result of a change in this state, also acts as one of the forms of manifestation of symmetry.

11. Declaration of Interest

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