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Research article

Taxonomy: Reading the Biological Diversity

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Abstract
The article deals with problem of application of the hermeneutical approach to understanding science and technology, which often faces a number of dead ends. In order to escape from them one needs a new vision of science. This helps understands science as a product of human creativity, which is hardly the representation but rather the construction of reality. Being so, it includes interests and values, aims and means, fantasies and desires. Scientific methods impose intellectual nets over nature that ascribe meanings to it. The case study of two main trends in biological systematics shows that natural biological diversity appears as a kind of unity ordered by classifications. A taxonomy grasping the structural unity represents a kind of artificial symbolic system, system of nomenclature based on the schematism of scientific imagination. Every taxonomy presents a "fictional," non-natural, human-dimensional, artificial picture of biological reality, but it is the such pictures that makes this reality understandable. And horizons of understanding oscillate between ontological, methodological and disciplinary structures of science. The prerequisite of the hermeneutical approach to natural sciences is understanding of science as a a humanist project. And the hermeneutical approach helps in turn enrich science viewing it as a creation of man. One enters here the hermeneutical circle, which is fruitful and provocative at the same time.

Keywords: Hermeneutics of science and technology; Interpretation; Science and humanism; Biological diversity; Biological systematics; Natural-artificial; Reality of taxon

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Научная статья

Таксономия: как читать биологическое разнообразие

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Аннотация
В статье рассматривается проблема применения герменевтического подхода к пониманию науки и техники, который часто приводит к ряду тупиковых ситуаций. Чтобы выйти из них, необходимо новое видение науки. Оно помогает понимать науку как продукт творчества человека, являющийся не столько представлением, сколько конструированием реальности. Таким образом, наука включает в себя человеческие интересы и ценности, цели и средства, фантазии и желания. Научные методы накладывают интеллектуальные сети на природу, приписывая ей смыслы. Ситуационный анализ двух основных трендов в биологической систематизации показывает, что естественное биологическое разнообразие предстаёт как некое единство, упорядоченное с помощью классификаций. Таксономия, охватывающая структурное единство, репрезентирует своего рода искусственную символическую систему, номенклатуру, основанную на схематизме научного воображения. Каждая таксономия представляет собой “вымышленную”, неестественную, человекомерную, искусственную картину биологической реальности, но это единственная картина, делающая эту реальность понятной. А горизонты понимания колеблются между онтологическими, методологическими и дисциплинарными структурами науки. Условием герменевтического подхода к естественным наука является понимание науки как гуманистического проекта. Герменевтический же подход в свою очередь способствует видению науки как человеческого творения. Мы вступаем здесь в герменевтический круг, который является плодотворным и провокационным в то же время.

Ключевые слова: Герменевтика науки и техники; Интерпретация; Наука и гуманизм; Биологическое разнообразие; Биологическая систематизация; Естественное-искусственное; Реальность таксона

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HERMENEUTICS – A NEW PROBLEMATIZATION

The problem-field of the article is an implementation of a hermeneutical approach to the natural sciences and technology. It It affords a new approach to representing the non-classical expansion of epistemological subject-matter and methodology. Yet there are many reasonable doubts about the legitimacy of this expansion since the opposition of two cultures (Ch. Snow) in science is still vivid and influential. Alfred Nordmann clearly articulates many of these doubts in his works, though at the same time he strongly encourages and endorses the search for the implementation of hermeneutical insights in science and technology studies. He noticed particular 'hermeneutic moments' in the scientific discourse.

> At these moments the models are the stage on which the negotiations take place and on which the top-down and bottom-up approaches become calibrated to each other. Moreover, [Nancy Cartwright's] hermeneutic characterizations treat the model not only as the site at which those negotiations converge, but in an interesting sense they turn the model into a protagonist of sorts, namely into a device that interprets, measures, or reads phenomena and theory and that promotes the attunement of concrete and abstract properties. (Nordmann, 2008, p. 372)

We shall see below how these considerations are applicable to understanding discussions in biological systematics.

Historically, the hermeneutical movement in philosophy arose as a search for meaning in texts and in the sciences deeply rooted in the life-world (*Lebenswelt*) (Dilthey, 1966; Gadamer, 1975). Conversely, technology has already been grasped as an application of human ends and means, abilities and desires, and hence open to the horizon of hermeneutical interpretation. However, the question if there are meanings to be discovered in the natural world outside the human one refers normally to the border between science and theology, naturalism and creationism. A proper example might be found in intelligent design theory (Numbers, 2006).

THE HUMANISTIC PROJECT OF SCIENCE – PREREQUISITE FOR THE HERMENEUTICAL APPROACH

The discovery of the human dimension of science, the understanding of science as a humanist project has considerable methodological significance in the given context: it contributes to the implementation of the hermeneutical approach to the natural sciences, at the same time excluding any supernatural mind. I single out three of such dimensions of science: history, values and communication (Kasavin, 2023). They reveal science's inseparability from culture and human agency and shape the sphere of meanings if not in the object of science, then at least in the scientific community and its knowledge claims.

The view of science as a way of communication, as an element of cultural history, as a moral challenge is the path to understand the capacity of scientific activity to build the life world, the genuine and unique surrounding of humankind. This surrounding in no way reduces humans to their natural Umwelt understood as mezzo-cosmos but rather contributes to the human unending quest to self-realization. Proposing to view science as a humanistic project, we enter the hermeneutical circle, in which science is able to comply with the values of humanism, and humanism itself is consistent with the pathos of scientific research. Today, reflections on humanism often fall in line with the analysis of the concepts of post- and transhumanism. This is especially the case when humanism is associated with modern science. Then the problems of humanism are actually identified with a new perspective of philosophical anthropology, i.e. a view of the future of humanity through the prism and promises made by science and technology of our days. But even this perspective cannot simply neglect the difficult question of the nature of the modernity in which we live and which shaped our societies.

Philosophy, no matter what it says, always speaks about human nature and destiny. What does it mean to be a modern person is the main question today. In the essay “On the Vocation of the Scientist,” Johann Gottlieb Fichte writes that philosophy begins with „the question of man“ in general, but ends with the project of that special person, the best of its kind – the man of science, the scholar or scientist, *der Gelehrte* (Fichte, 1864, p. 59). This apparently immodest and even overly ambitious thesis should be understood not as self-glorification of the intellectual or an advertisement for the science of the late 18th century, but as the advancement of an almost unattainable ideal. Fichte believes that the pursuit of science makes people better, and only the best of people can develop true science. Let us remember that at that time science had not yet come to the centre of public attention. The French Revolution was underway and executed a number of renown scientists, but soon it would be in dire need of them. The industrial revolution was beginning, and it required advanced technology, but it was yet to be understood that there were scientific achievements that would give an impetus to its development. Universities legitimized by the papal bull died, and almost no one linked their fate with science. That is why Fichte puts forward his thesis in open contradiction to the tendencies that were taking place on the surface of social life. The philosopher considers the roots and ten years after Immanuel Kant answers in his own way the sacramental question “What is the Enlightenment?”: Enlightenment is the triumph of science as it forges the new man. In this way, Fichte deciphers and clarifies Kant's answer: the coming of age of the modern human symbolizes not just the courage to live by one's own mind, not just the ordinary independence of thought, but the systematic study of science, that is, the difficult and self-sacrificing intellectual work for the benefit of society.

Michel Foucault reminds us of the polysemy of the term “humanism” and its complex relationship with the Enlightenment and modernity (Foucault, 1984). In short, if the humanistic project is only an explication of a dogmatic system of values, then it has many chances to degenerate into a tragedy of human destinies. And here we are forced to take a critical look at science and think once again about its human purpose. The humanistic advantage of science is not only and not so much in the fact that it reveals the truth to us or yields technical benefits. Science forces us to think historically and critically about ourselves and our present, encourages archaeological excavation of the past and genealogical discourse about the future, it sets boundaries and seeks means to overcome them. To be sure, scientists are not ones to believes in their own modernity with a personal understanding of the ideals of humanism. On the contrary, in the desire to be at the height of their time, they realize that the human being as an empirical subject never corresponds to the concept of humanity. Moderns are the only ones who use science in an endless search for themselves. Therefore, true humanism is not the exaltation of the human, but brings humanity to consciousness; not adaptation to conditions, but the creation of oneself anew; not a doctrine, but a constant criticism of our historical existence.

HOW HERMENEUTICS ENRICHES SCIENCE

The hermeneutics of science addresses the problem of how a philosopher, a humanitarian, or a social scientist in general can act as a mediator in communication with other scientists and with public agents. The main idea of this approach is to return to science all the richness of social, cultural, and intellectual life, in which science is *de facto* immersed. It is to revive all the excessive socio-cultural content from which modern science is trying to mostly dissociate itself; to remind the public and scientists about means of understanding science at its true value as a global social and ideological problem, like a gift that no one is able to reject.

In this context, there would be a philosophical and historical naivety to uncritically accept Thomas Kuhn‘s concept of "normal science," especially a view of contemporary science with its "polyparadigmatic" nature in its theoretical, experimental, instrumental, disciplinary, infrastructural, social dimensions, and what Karl Popper referred to as its "permanent revolutions" (Kuhn, 1963; Worral, 1995). And if this is so, then the constant change of meaning and sense, the process of interpretation accompanies the personal development of scientists even within the same generation and within scientific communities. In particular, scientists become more sensitive towards epistemic and moral controversies, towards understanding each other, theoretical and empirical novelties and besides all, to the impact of science on society and *vice versa.*

TWO TRENDS IN THE METHODOLOGY OF BIOLOGICAL SYSTEMATICS

In the following I will limit myself to the analysis of a peculiar kind of scientific meaning provided by the systematic ordering of natural diversity, that is by the search for a proper typology, for classification and taxonomy in biology.

My hypothesis runs as follows: the systematic (typological, classificatory, taxonomic) interpretation of a certain set of entities as an object of scientific research is a fundamental condition for any particular conceptualization. According to a holistic understanding, a top-down movement is the starting point of theorizing and not the result of creating a particular conceptual construction. Classification is a presupposition for conceptualization not *vice versa*.

Yet the question of what exactly ensures 1cognitive integrity – perception, imaginative thinking, or language – remains open and needs further research. The psychology of perception provides experimental arguments in favor of wholeness, while formal logic appeals to a construction from elements of the conceptual system („elementarism"). Both contain ontological and methodological presuppositions that determine their interpretations of the same empirical phenomena. This sphere of pre-understanding may be well a subject matter of hermeneutical study.

I carry out the testing of this hypothesis in the form of a case-study dispute in the field of biological systematics, namely that between typological evolutionary systematics[1] and the methodology of cladism.[2] Here two trends confront each other, which in philosophical terms can be designated as intuitionistic and logical-methodological ones, respectively.

EVOLUTIONARY HOLISM

In evolutionary systematics, priority is given to a holistic interpretation based on typology, natural phylogenetic classification, and the notion of the species as an element of biological reality. Basic to evolutionary systematics is a individual concept with its features of affording artificial classification as well as unambiguous analytical rigor, computer modelling, and the concept of taxon as an element of classification.

Hermeneutically conceptualized, the relationship between concept and classification reminds of the traditional hermeneutical circle of meaning and understanding. In turn, holism and elementarism might be presented as two types of ontological vision with different theoretical horizons.

The main task of systematics is to order natural diversity, to make it understandable, to give it meaning. The dominant tradition in biological systematics draws on ideas coming from Carl Linnaeus and Charles Darwin about biological reality and methods of its ordering. This is an evolutionary theory, including the modern synthetic theory of evolution. I propose that its philosophical interpretation consists in reconstructing the horizon of pre-understanding, namely the ontologies that underlie both evolutionary systematics and cladistic classification. The basic controversy rests in the concept of kinship and its applicability to higher taxa: kinship is to be interpreted either as an instrumental or an essential criterion of classification.

Thus, the main ontological category within the framework of modern evolutionary thinking is that of the species which is considered as an individual by its status (Hull, 1976). Here, the „individual“ certainly does not refer to a single flower, shrew or oyster, but a population of organisms united by a species, having special characteristics of nutrition, reproduction, genetic commonality, etc.

The unit of evolution is considered to be a species, and the main evolutionary events are the appearance and disappearance of species. A species presents the genuine "natural kind," and the higher taxa demonstrate a gradual descendance of this naturality. From this point of view, all higher taxa and subspecies are conventional, artificial kinds, or classes of phenomena. In relation to them, such terms as "origin," "extinction," or "divergence of features" presuppose metaphorical application, without implying an ontological content proper. Evolution proceeds, so to speak, from the bottom up, from species to

[1] To mention only few its main representatives: George Gaylord Simpson (1961), who coined the term "synthetic theory of evolution" in 1949, Thomas Cavalier-Smith and, in Russia, Armen Takhtajan.
[2] The father-figure of cladism is Willi Hennig (Hennig, 1966), among its current representatives in Russia are Anatoly Shatalkin and Igor Pavlinov (Shatalkin, 1991).

higher taxa. If a species is divided into several species, then the term "genus" enters the game. If in the course of evolution, a species as a lower taxon precedes a higher one, then in classification time it is *vice versa*. And the fact that a taxon of a higher rank is by definition higher is a "retrospective artifact" that owes to the concept of monophyly (birth from a common ancestor). Here, the artificial nature of the classification manifests itself here (Pozdnyakov, 1996). Accordingly, any evolutionary systematics of phylogenetic relations that uses the terms "kinship," "ancestor," and "descendant" will be correct only in relation to species as real biological individuals (populations).

CLADISTIC ELEMENTARISM

Contrary to evolutionism, a species in cladistics has the status of a class or a set-theoretic construct (Shatalkin, 1983), and this leads to the use of these terms as if they are devoid of ontological foundations: kinship is nothing more than similarity.

Let us recall that cladistics is a trend in biological systematics which develops the ideas of the German biologist Willi Hennig and relies in its more modern version on the falsificationism of K Popper (Shatalkin, 1991; Lovtrup, 1979). Cladistics designs a chain between three concepts, namely 1) semogenesis (the creation of meaning), 2) phylogeny (understanding of similarities and differences between species), and 3) classification – then postulating a kind of isomorphism between them.

One may require here a terminological and substantive explanation regarding the key taxonomic terms of cladistics, denoting similarity and kinship. So, the condition of a proper taxonomic grouping (a clade) is dubbed „monophyly“ and has to meet the following criteria:

a) the grouping contains its own most recent common ancestor (or more precisely an ancestral population), i.e., excludes non-descendants of that common ancestor;

b) the grouping contains all the descendants of that common ancestor, without exception.

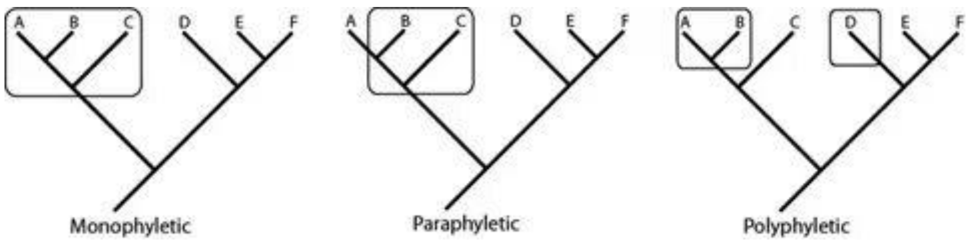

Fig. 1. Taxonomic grouping.

Monophyly should be evidentially interpreted as an unobservable hypothetical taxonomic phenomenon. Empirical evidence for the presence of monophyly draws on the conclusion about the relationship of three taxa – two sister species that arose as a result of the separation of the third line of ancestral species.

This relationship is called „synapomorphy,“ which denotes the kinship of two species. If a trait exists in two organisms and is present in their last common ancestor, it may indicate the presence of a clade. „Clade“ is a key term for cladism, referring to the relationship of all groups within a cluster to one common ancestral group. A set of clades forms a cladogram – a family tree of the origin of organisms. The initial hypothesis about the presence of a clade, that is, the origin of the group from a common ancestral line, can be justified by morphological, genetic, and other data, which allows it to obtain the status of a stable taxon.

HOW CLASSIFICATIONS LIE: RODENTS AND LAGOMORPHS

So let a monophyletic group (taxon) be a group (of organisms), to which descent from one group of the same taxonomic rank is attributed. However, the gradual accumulation of morphological, paleontological, ecological, and other data on individual groups of organisms makes it necessary to divide them into independent ones. A typical case is the story of the order of rodents (squirrels, dormice, mice, rats, and many others), which in contrast to the latter included lagomorphs (rabbits, hares, and pikas as a suborder.

Later, the similarity of lagomorphs with rodents was declared external, and they were separated into independent orders of different origins (Gidley, 1912). The situation is complicated. In 1855, Johann Friedrich von Brandt (1802–1879) coined the now widely used term 'Lagomorpha' for this group, albeit in a subordinate rank among rodents (along with Sciuromorpha, Myomorpha, and Hystricomorpha). Brandt was a German-Russian biologist-naturalist who in 1831 emigrated to Russia and was the appointed director of the Zoological Museum of the St. Petersburg Academy of Sciences.

Moreover, although he explicitly referred to lagomorphs as a suborder (Subordo IV. Lagomorphi seu Lagomorpha'), Brandt began his discussion of these groups with the words "Ordo Leporinus...," emphasizing their sharp difference from rodents, based on the presence of four upper incisors in lagomorphs.

Thus, while it can be argued that Brandt was the first to propose an ordinal status for lagomorphs, it was not accepted until 1912 when James William Gidley officially called for an ordinal rank for lagomorphs (Smith et al., 2018, 4–5). However, in terms of cladistics, rodents and lagomorphs are sister taxa, and both constitute a monophyletic group known today as dormouse (Smith et al., 2018, 8).

The investigations of the German-Russian biologist Brand were ignored for 50 years. This may be seen as a form of "epistemic injustice" (Fricker, ??). While it would appear quite natural that after Charles Darwin the authority of the British biological community played a privileged role in the 19th century, biological systematics reveals value- and social ladenness.

In a similar way, until recently, falcons and owls were combined into one order of birds of prey, when in fact they are two genetically different groups of birds. As soon as the polyphyletic nature of this taxon was revealed, it was divided into the orders of Falconiformes and Owls.

As we can see, the main goal of cladistics, in contrast to evolutionary taxonomy, is to reconstruct taxa in such a way that they exactly correspond in form to clades. However, it has not been possible to present the entire biological classification in the form of a cladogram, that is, to substantiate the isomorphism of semogenesis, phylogeny, and cladogram for all taxa. In fact, the precision and rigor of the formal cladistic interpretation contradicts empirical interpretations in biology, which constantly deal with the incompleteness and inconsistency of any taxon. If so, the epistemological and ontological status of taxa is fictional: they are wrong rules of reading the biological diversity similar to mathematical formulae which can be far ahead of or essentially deviate from the empirical practice of science.

CONCLUSION

I will conclude in saying that the most balanced scientific biological interpretation would result from a combination of both methodologies, although cladism is now the global mainstream in the context of the digitalization of biology.

Arguably, however, the holistic interpretation of biological diversity is preferable, although in philosophy and science the dispute between holism and elementarism is unresolvable and represents an eternal clash of interpretations (Kasavin, 2024). I suppose that there are disciplinary structures in the particular scientific community, which essentially determine decisively the theory choice, and these are linked to questions of historical dominance, temporary conservatism and authority, epistemic injustice, science wars and scientific revolutions, pseudo-science, ethical controversies (Kasavin, 2021). Since there is interpretive flexibility, the dominant interpretation or biological self-reflexion is always competitive, historically and socially laden. As Hans-Georg Gadamer puts it, "to be historically means that knowledge of oneself can never be complete" (Gadamer, 1975, p. 301-302).

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