Authority and Scientific Paradigms

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ABSTRACT:
The state of European science at the end of the sixteenth century resembles a kind of epistemological chaos in which there are no clear landmarks and boundaries of the world. Not surprisingly, as some order took shape within it, the revival of science began. It should not be forgotten, moreover, that the word "order" itself is etymologized as cosmos, and the discipline that studies it is cosmology. That is why the first fundamental works on astronomy – Copernicus's "On the Revolutions of the Celestial Spheres" and Galileo's "Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican" – bear such pretentious titles, because they aim to put the whole "world system" in order.
The concepts of scientific determination and the objects of cognition must be present in the problem field of the cognitive process, and the problems of knowledge translation and communicability between the subjects of cognition, as well as the extremely complicated interdependencies between the agency of the scientist and his cultural-historical context, should directly and unconcernedly raise the question of defining the range of epistemic values in which the value of truth a priori could not be put in contradiction to the value of one's outer for the phenomenon heuristic potential or to the consistency of the relevant scientific noosphere

KEYWORDS: Heliocentrism, Science, Cosmology, Authority, Copernican Turn

INTRODUCTION
Such a rational mindset as we know in the European is not relevant to any other culture. The traditional cultures of the East, where philosophy developed in a direction opposite to the European appeal to the accumulation of scientific knowledge, are characterized by reflections on trivial language and problems of morality, art and religion. In Western philosophy (especially in the late nineteenth and the first half of the twentieth centuries) there was a marked tendency to equate reflection on science with worldly analysis of other areas of culture. At the same time, the philosophical analysis of science was constituted as a special and actively developing field of philosophical knowledge. The fact is that science is also changing historically. If we compare the natural sciences of the twentieth century with the natural sciences of the seventeenth and nineteenth centuries, we will inevitably find that it is not just the system of ideas about nature that is changing, but also the methodology of scientific knowledge itself. Scientists of the classical era believed that the conditions for the objectivity of theoretical explanation precluded any attempts by the knowing subject to change the means of observation and the consistency of thinking. Therefore, they would not accept the ideals and norms established in quantum relativistic physics, where the principle of relativity to the means of observation becomes the basis for the theoretical description and explanation of phenomena. Classical science assumes that nature's answers to the questions posed by science are determined solely by the essential characteristics of nature itself. The ideal of the objectivity of knowledge in modern science receives a different interpretation. In formulating the methodological postulates of

modern physics, Werner Heisenberg wrote that whether nature will answer our questions depends not only on its constitution but also on the very way the questions are posed, i.e., on the place of the observer in nature as a macro being, as well as on the historically evolving methods and means of knowledge. Compliance with this circumstance becomes a condition for obtaining objective knowledge of nature (Heisenberg;2011).

1. THE HELIOCENTRIC TURN

The research capabilities of the basic sciences depend on the nature of the socio-cultural environment in which they develop. It is not only a question of the social support of this or that program or its funding, but also of the deeper determinism of scientific research. At any given stage in the development of a basic science, there may be several competing research programs. Their fate depends on their ability to address the empirical and theoretical tasks at hand, as well as their ability to reconcile them with the available cultural tradition. The latter applies to both the natural sciences and the social humanities. Recently, selection in some fields of research on cultural tradition has become more explicit. In this respect, philosophy is not particularly different from the other social sciences and humanities. Quite often, defending fundamentally new views of the world, going beyond tradition, philosophical reflection resorts to various "tricks" – an attempt to prove the new, reconciling it with traditional ideals.

When Galileo defends his fundamentally new (compared to the medieval tradition) ideal of knowledge of nature – its mathematical description – he uses the traditional notion of medieval culture: nature is a book written by God, which contains within itself the conception of the divine creation, the deciphering of which leads to the goal of knowledge. The only thing Galileo adds is that the Book of Nature is written by God, but in the language of mathematics. (Galileo;1623)

Fundamental science is constantly generating new conceptions of the world, cognitively adhering to objects and processes that often become the subject of mass practical assimilation, but in the projection of a more distant future. Knowledge of these objects inevitably brings changes to our picture of the world. It requires certain adjustments to the world-perceiving orientations established in culture. For this knowledge to be incorporated it needs to be equalized with the dominant world-perceiving tradition. This task is solved thanks to the philosophical grounding of new scientific conceptions seeking their place in the world picture. The philosophical controversies surrounding Darwin's theory, relativity theory, quantum mechanics, theories of a non-stationary universe... are a vivid enough illustration of the complexity of the process of incorporating into culture scientific ideas that change the meaning of its world-perceiving universals. Philosophical reflection is used not only in the capacity of justifying already acquired knowledge, but also directly participates in scientific inquiry in the capacity of a substrate that appropriates its heuristic ideas and principles. There is a vast amount of literature on the history and philosophy of science – starting with Galileo and ending with modern fundamental discoveries – where many such situations are analyzed. I would like to refer to Niels Bohr's development of the principle of complementarity. This development is essentially related to the philosophical ideas of the Dane Søren Kierkegaard. Bohr's own reflections on the place of the observer in nature as a macro-creature and on the principle macroscopicity of the devices that create the conditions for observing micro-objects can be found in a similar form in Kierkegaard without much difficulty. (Danin;1978) Of particular interest, from the point of view of optimal extemporal emblematism, are modern inflationary theories of the architectonics of the universe and their philosophically grounded justification. Even a cursory glance at the contemporary methodology and history of science convinces us of the radicalism of already accepted standards and norms explaining the dynamics of scientific knowledge in general and its cosmological ingredient in particular. Nicolaus Copernicus's proposed system of the world – an alternative to Ptolemy's one – could hardly today raise the slightest doubt about its apodictic character. The conceptual apparatus that the representatives of postpositivism tried to impose in the middle of the twentieth century contains within itself a whole set of socio-political terminology of a post-revolutionary reality. The latter is perceived as a rear-guard of the Copernican "revolution" so widely touted in astronomy, also referred to by names such as the "Copernican turn". The concepts launched by postpositivism, such as: "revolution", "turn", "decay"... are not accidental, but owe their existence to the continuity, not only terminological, but also tendentiously accentuating its meaning in the New European genesis of terms. Phraseologies such as: "scientific turn", "scientific revolution", "collapse of scientific paradigms", "crisis of scientific theories" entered methodological circulation under the influence of the socio-political sphere of historical-methodological research of the mid-twentieth century, undoubtedly giving a dramatic nuance to everyday routine scientific activity. It does not follow, however, that these exaggerated word-definitions rationally make it more attractive because what is described in such a dramatic way may not correspond to reality at all.

It would be incorrect to deny entirely the importance of this heuristic, which entails the sociologically oriented methodology of science. In speaking of the Copernican revolution, we will demonstrate its immanence in the more general and fundamental process of "scientific revolution" and "paradigm shift" in astronomy and cosmology. Refracted through this prism, the "turn" carried out by Copernicus could be seen as a kind of return to the roots of the European scientific and philosophical vision.

The famous American philosopher and historian of science Thomas Kuhn noted the following, "In the early sixteenth century more and more of the best European astronomers recognized that the paradigm in astronomy was failing to solve its own traditional problems. This recognition was a prerequisite for Copernicus to reject the Ptolemaic paradigm and seek a new one" (Kuhn;1996; p. 86) The question of interest here is: what exactly led Copernicus to undertake such an ambitious task? Kuhn believes that the reason is rooted in the inability of the science of the time to deal with even the most trivial problems arising in the course of its development, such as those related to the social need to reform the calendar and the critique of Aristotelianism, which gained immensely wide popularity in the Middle Ages. "But dealing with technical problems," he writes, "remains the core of the crisis (Kuhn;1996; p. 86)

This situation so picturiesquely described in astronomy and cosmology can be characterized by the simple word 'disorder'. Generally speaking, the state of European science at the end of the sixteenth century resembles a kind of epistemological chaos in which there are no clear landmarks and boundaries of the world. Not surprisingly, as some order took shape within it, the revival of science began. It should not be forgotten, moreover, that the word "order" itself is etymologized as cosmos, and the discipline that studies it is cosmology. That is why the first fundamental works on astronomy – Copernicus's “On the Revolutions of the Celestial Spheres” and Galileo's “Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican” – bear such pretentious titles, because they aim to put the whole "world system" in order. To this day it is not clear exactly what Copernicus was undertaking when he justified the shortcomings of the Ptolemaic system. According to Kuhn, he was trying to solve some technical conundrums within the old systems. When convinced that this was impossible with their help, he rejected them as effective mechanisms. We could not disagree with such an iron argument. But the basic question, what served as the cause or impetus for this "turn" of his cognitive mind-set, remains. On this occasion Kuhn writes: "Above all, he (the researcher) will often resemble a man who looks for something in hindsight, who performs experiments simply to see what will happen, who wants to discover a phenomenon whose nature he cannot unravel..."(Kuhn;1996, p. 104) Judging from this, we witness an absolutely indeterministic activity. The scientist relies entirely on the will of chance, and the new paradigm itself acquires the status of a happy accident. A little further on Kuhn “insures” himself in the following way: “But at the same time, since no experiment can be carried out without a theory, the scientist working in a period of crisis is constantly striving to construct speculative theories which, if they prove successful, may open the way to a new paradigm, and, if they prove unsuccessful, may be rejected without much regret.” (Kuhn;1996, p.104) Without worrying about compromising the truth, we might call this strategy “trial and error” – a kind of sifting of physical, cosmological or some other reality. It bears the obvious imprint of the spirit of New-European empiricism, and at the same time harbours the germs of revolutionarity, whether scientific or social. It is clear from the quotation given that "theory" is understood not as a self-sufficient "looking-at-it-comprehension," but as the foundation of experience – its background. Hence contingency and “trial and error”. Not to be glib, we will return to Copernicus' essay.

The author of “De revolutionibus orbium coelestium” does not even rely on random solutions to the hard-to-explain problems, much less build any "working" speculative theories. His own explanation is as follows: "I began to guess that for philosophers there was no more reliable theory of the movement of the world mechanism (...) I therefore set about reading all the books by philosophers that I could find. I was trying to find out whether anyone had ever made statements concerning the rotation of the heavenly bodies which were, however, different from those taught in mathematical schools. At the very beginning, I found a statement by Cicero, who spoke of Nicetas, who opined that the Earth moves. Then I also read in Plutarch that this view was held by others. To make it clear to all, I quote the words of Plutarch: “Others held that the Earth was stationary, but Philolaus the Pythagorean held that it moved round a central fire in an elliptical circle just as the Sun and the Moon did. Heraclitus of Pontus and the Pythagorean Ecphantes also made the Earth move, but not gradually, but in the manner of a wheel, from west to east around its own center.” "Prompted by this, I also began to ponder the mobility of the Earth" (Copernicus;1964, p.68)

We might ask where is the place of the random experiment with a happy ending for the researcher, or the practical implementation of "trial and error" method? The above quotation does not give any reason to agree with Kuhn about the reason for the "turn" of the cognitive attitude in the researcher. Copernicus literally leaps from the system of Eudoxus (which received physical justification in the writings of Aristotle and became established in ancient science and philosophy through the authority of the latter and was subsequently refined by Ptolemy) to those of Pythagoreanism and Platonism.

In Chapter 11 of Book I of “On the Revolutions of the Celestial Spheres”, where the triple motion of the Earth is proved, we witness a geometrical argumentation not so close to the spirit of "chance experiments", bearing a theoretical character of its own. The predominance of the hypothetico-deductive (inherently theoretical) method over the "trial-and-error” method is not only not concealed by Copernicus, but is tendentiously emphasized. His basic hypothesis was that "the diurnal rotation of the Earth on its axis, its annual motion around some supposed center, and its declination, force the axis of the Earth to remain in the same unvarying position, whereby all appear as if they were motions of the Sun." Here the author refers directly to the source of his hypothesis, the Pythagorean Philolaus. Based on these and similar considerations, the latter had drawn these conclusions nearly two millennia before Copernicus. The same thesis was defended by Aristarchus of Samos. But neither Philolaus nor Aristarchus could overcome the authority of Aristotle. (Russell;1994) At the end of the chapter, Copernicus cites his translation of Lysias's epistle to Hipparchus to emphasize the difficulty of being able to hold beliefs that can only be realized with a "sharp mind" in the face of a corporate Pythagorean "initiation" that stands far apart from the widely held views of Stagirites in late antiquity and the Middle Ages that were untrue in this respect.

2. THE ROLE OF AUTHORITY IN SCIENCE

Here the question naturally arises: does Kuhn ignore the Pythagorean continuity of Copernican "discovery"? To answer the question satisfactorily, it is necessary to understand how he explains the phenomenon of Pythagoreanism and its followers – Heraclitus of Pontus and Aristarchus of Samos – on the question of explaining the structure of the world; how Pythagoreanism fits (or does not fit) into Kuhn's model of "paradigm shift". It is clear that if Kuhn acknowledges the importance of this phenomenon for Antiquity, the model in question (and with it all its modifications: "scientific revolution", "turn", "crisis"...) will simply hang in the air. It is also understandable that Kuhn seeks – from the point of view of affirming the importance of the "Copernican turn" in the sixteenth century, i.e. a visual demonstration of a paradigm shift in that era – to downplay the role of Pythagoreanism in Antiquity by presenting it in the form of an "incomprehensible hieroglyph". In his book "The Copemican Revolution" Kuhn makes a similar point about all ancient Greek heliocentrists: "These alternative cosmologies (...) are uncannily similar to our modern views. Today we believe that the Earth is one of many planets revolving around the Sun, and the Sun is only one of many stars, some of which may have planets of their own. And while some of these abstract assumptions provide a basis for talking about a particular tradition in antiquity – and ignoring the fact that they all served as an immediate source of intellectual stimulus for innovators like Copernicus – they are not supported by original arguments that would lead us to believe them today. It is because of the absence of such arguments that these assumptions have been rejected by ancient philosophers and almost all astronomers." (Kuhn;1957, p.42)

Copernicus makes a number of similar arguments but considers one of them to be fundamental – the triple motion of the Earth. The latter, according to him, led Philolaus and Aristarchus of Samos to the heliocentric explanation of the structure of the world. From this we may conclude that it is not so much a matter of his own cosmological and astronomical arguments as of something else. This "other" is noted by Kuhn himself: "... alternative cosmologies destroy all basic notions of the structure of the universe verifiable by sense perception." (Kuhn; 1957, p.42) In other words, the epistemological stable constellation of the apparent world dominates that of the non-apparent. And Aristotle's empiricism, as demonstrated in his Physics, is, of course, much better suited to the "round-the-clock rotation of the firmament" observed with the help of sense perceptions. Aristotle's authority, epistemologically grounding the sensuous (empirical) obviousness of Eudoxus' geocentric system, played in this case an extremely negative role. For the sake of lucidity, we will cite one of the most common "arguments from obviousness" put forward by the Philosopher against the Pythagorean doctrine: "The Italian philosophers known as Pythagoreans hold the opposite view: at the center, they believe, is fire, and the Earth – one of the stars – moves in a circle around the center, causing the change of day and night (...) without seeking theories and explanations consistent with the observed facts, but distorting them and trying to subsume them under some theories and views of their own" (Aristotle;2024,II,13,293a,20 - 27) The question of why Aristotle disagrees with the Pythagoreans is of interest. Here is how he himself explains it: "…it is obvious and accepted as axiomatic that the universe revolves in a circle ..." (i.e. it is not the Earth that revolves around the Sun, but only the firmament). Moreover – even – he formulates a kind of epistemological principle: "Only what we observe in reality in many or in all cases can be asserted with sufficient justification."(Aristotle;2024,I,10,17 - 21) In other words, for Aristotle, as for hundreds of thousands and millions of people, the "immediate obviousness" of sense perception becomes the weightiest argument. This was also the case in the fourth century BC and the sixteenth century AD. In two millennia, nothing changes in principle. It is surprising, however, that even such a coryphaeus of ancient philosophy and science as Aristotle, who favored "notorious reasoning" and "observable facts," failed to diminish the popularity of heliocentrism among its proponents. Obviousness as the main argument played a crucial role in Antiquity in the formation of man's conception of the structure of the Cosmos-Universe. And Aristotle's "empiricism" became the "altar" before which most philosophers and scientists, both from the time of Philolaus and Copernicus, bowed without due reflection and criticism.

Kuhn understands perfectly well that non-obviousness serves as a major barrier to the ubiquity of heliocentrism: "The idea that the Earth moves is initially perceived as utter nonsense."(Kuhn;1957, p.43) Moreover, he overlooks one essential fact: the first models of a non-obvious world originated primarily among the Pythagorean mathematicians, who took the epistemological foundation of non-obviousness as the basic tenet of their worldview. It is the speculativeness of their convictions that gives us that "freedom of scientific thinking" so lacking in the "ancient empiricists" who are only able to see in it "some theories and views of their own." This is the reason why Kuhn believes that "the main impetus for any revolution in science is the discrepancy between theory and observation." (Kuhn;1957, p.75) On the other hand, as the history of Copernican, relativistic, and inflationary cosmology shows, what Kuhn calls "revolution" occurs not by virtue of such "discrepancy" but for "purely speculative reasons." Each time a breakthrough is reached, it is when either the argument for the obviousness of the observed facts is questioned, or the latter are not taken into account at all (until Alexander Friedman, no one generally observed the evolution of the universe); of course, this is not at all about the observation of the inflation of the universe, which, according to inflationary theory, refers to the early stages of its evolution.

The American historian of science Wrightsman suggests another label for Copernicus' discovery – not "revolutionary" but "reformist". Examining what he has written from an epistemological rather than a historical-astronomical and biographical point of view (as Wrightsman does), we could not help but join his assessment: “If by the term "revolutionary" we understand some event or movement that sets in motion a process that in a relatively short time irreversibly changes the structure and course of development of established systems, then in this sense the last thing Copernicus would have been is a revolutionary. He set out to renew astronomy, but his methodology and arguments remain traditional. And his main idea – the motion of the Earth – is not inherently new. The innovation lies in the fact that this idea and its derived cosmological system are beginning to establish themselves as true" (Wrightsman;1987, p.98).

Even the ancients were aware of the fact that it is difficult not to attain the truth but to remain with it – to restore the true system of creation to its original place, but not thereby to overturn the world, as the adepts of "revolutionary" approaches seek to do. Aristarchus of Samos himself almost paid with his life for his heliocentric beliefs. And Aristotle's ridicule of the "scientism" of the Pythagoreans and Plato was sustained almost until the end of the seventeenth century, of course, now only by ecclesiastical dogmas. What Copernicus did could therefore be described in the literal sense as a scientific feat. This reminiscence of Copernicus makes it possible to clarify better the intellectual atmosphere in which not a "turn" was carried out on the view of the universe, but something much more important for the understanding of European science and the type of rationality that dominated its creators – a return to the ancient Pythagorean roots. By breaking away from the Aristotelianism of Ptolemy and his followers and gravitating towards Pythagoreanism and Platonism, European philosophy did not merely exchange one paradigm for another, but by departing from the wrong path, discovered the possibility of an adequate perception of reality.

The grounds for this accession must be sought in the profound epistemological dogma of the impossibility of proceeding from an idea when speaking of a self-evident world. Another such fallacy is the belief in the impossibility of obtaining true knowledge of the physical and cosmological structure of the world by relying only on the self-evident world. Here we observe a transition from the "qualitativism" of Aristotle, according to whose view the available physical knowledge is conceived of as reliably given in the sensible, to the Pythagorean-Platonic "quantivism", admitting the obtaining of plausible physical and cosmological knowledge from the domain of the non-obvious – as conceptualized by the mind by way of mathematical correspondences. To a considerable extent, the advent to the consideration of the non-obvious in the physico-cosmological world since the time of Copernicus is stimulated by the analysis of the "relative nature of motion", begun already by Nicholas of Cusa and completed only in the principles and laws discovered and established by Galileo. A significant contribution to the understanding of the "non-obvious" is also made by astronomy itself: the consideration of the nature of reflected light and the analysis of the three types of motion of the Earth.

The realization of the fact that the most adequate qualitative description of the physico-cosmological world becomes possible only under the condition of its numerical-motor (i.e. mathematical) description and explanation. Here, too, one finds this re-advent to Pythagoreanism and Platonism. In the interpretation of the world-system in its totality, number is given such a primary role as it has in the Pythagoreans and Plato. In a sense, even, thanks to it, the qualitative world can indeed be understood.

Understanding as a projection of meanings created by reason is the prerogative of the human being alone. That is why thinking about nature is inseparable from thinking about man. Here, of course, it is not merely a question of man's "physical presence" in the image of the world or of some natural-scientific representations of fragments of reality, but of the "prism" of human values and purposes, through which the cognizant subject views his "environment" and the world in which he is destined to live." (Berdyaev;1995, p.290)

Through the above, we would like to stress once again that overcoming the illusions associated with objective thinking, to which the "ecopogization of natural science" leads, does not at all mean any kind of overcoming of classical natural science, but on the contrary - the presentation of its original metaphysical premises and grounds, which quite often remain in the shadow of meta-scientific reflections.

Following this logic, we are not far from the conclusion that the changes in the understanding of the object of scientific knowledge have a binary character. On the one hand, there is an expansion and complication of the object sphere in science at the expense of the new objects included in it, most of which are themselves the product of scientific and technological development (e.g., systems based on artificial intelligence, biotechnological and sociotechnical structures). If we look more closely, we cannot help but know we are not dealing here with a simple expansion of the object world, but with its radical "anthropomorphisation" (Archer;1989, p.24). We can now speak of a new systematization of natural characteristics, because of which man becomes intrinsic to the image of the world, but not as a thing, along with other things, and not even simply as an active participant in natural processes, but as a system-forming principle, as the starting point for all coordinates, as the initium of all knowledge of the world. On the other hand, it becomes clear that thinking of such objects (of such a world) is invariably linked to the characteristics of the cognitive subject: the means of cognition, the goals and values that guide the self and according to which the cognitive process itself is oriented.

If these changes are understood correctly, i.e. non-appreciatively and without prejudice, we could predict a peculiar tendency towards reforming the scientific conceptual apparatus. Above all, this has to do with the revision of the notion of rationality. The theory of scientific rationality itself must include in its conceptual paradigm the unity (not the declared, but the real) of subjectivity and objectivity. The meaningful conjunction of these concepts must become the quintessence of the cognitive process. The latter should ensure free access in science to such philosophical categories as "truthfulness", "necessity", "adequacy of the ends and means of knowledge"...

CONCLUSION

In this article we have tried to show that both the concepts of scientific determination and the objects of cognition must be present in the problem field of the cognitive process, and the problems of knowledge translation and communicability between the subjects of cognition, as well as the extremely complicated interdependencies between the agency of the scientist and his cultural-historical context, should directly and unconcernedly raise the question of defining the range of epistemic values in which the value of truth a priori could not be put in contradiction to the value of one's outer for the phenomenon heuristic potential or to the consistency of the relevant scientific noosphere.

In cognitive terms, the boundary between the subject and the object of scientific knowledge remains, of course, quite relative, and these categories do not themselves form a derivative relation, but a system, the elements of which make sense only if they are in a relation of interdependence or of conditioning by the system in its entirety. Such a system could become the basic construct of a new future type of philosophical-scientific perception, focusing on itself the prospect of a restoration of the once lost unity of man as knower and the world as knowable.

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