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Arab Scientific Rationality: From Deconstruction to Reconstruction

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Abstract:
European historians of science, and those who follow their approach, usually move from ancient science (Greek Aristotelian) to modern European science, considering the Middle Ages between them as an era of ignorance and darkness, because the minds of other races according to Eurocentrism are deficient and incapable of scientific creativity. But the opposite is true, as Arab scientific rationality refuted Greek theories that represented scientific traditions, and established new sciences and scientific theories on new foundations and a philosophy that completely differs from the Greek model, which contradicts modern scientific discourse, and paved the way for the modern scientific revolution. Without their scientific efforts, the course of human civilization would have been delayed for many centuries.
Keywords: science, method, Arab rationality, deconstruction, reconstruction.

Introduction:

The true history of humanity is scientific history, as scientific revolutions are what shaped human reality and mind. The Arab man moved from Bedouin life to civilization thanks to Islam first and science second. Islamic civilization was not a civilization of jurisprudence and poetry only, as some Orientalists and those who follow them assumed, but rather a civilization of rational and transmitted sciences, both mathematical and natural, which made it a distinctly scientific civilization.

In this article, I sought to shed light on the reality of Arab scientific rationality in Islamic civilization, how it dealt with foreign sciences, especially Greek ones, and how it subjected them to revision, questioning, and criticism, revealing their shortcomings and the fragility of their methods, including Aristotelian logic, and building new sciences on methods and foundations different from the Greek rational deductive model. This article, which belongs to the philosophy of science, aims to reveal the truth of the critical scientific spirit in Arab natural and cosmic sciences, which produced a methodological and epistemological revolution and brought about a major transformation in the history of science.

The problem addressed in my article is: How did Arab scientific rationality deal with Greek natural sciences? Was its role limited to translating and explaining Greek sciences, and thus were its natural and cosmic sciences merely Greek sciences formulated in Arabic? Or did it instead break with them and produce a critical revolution and a scientific model different from the Greek one?

The most prominent hypotheses of this research are:

Arab natural science is not merely a refutation of Greek science, but a re-production of it on new foundations and methods and without precedent, making it an original scientific creativity. If sound methods are the basis of all scientific creativity, Arab scholars realized that Greek rational methods, including Aristotelian logic, were an obstacle to scientific discovery, as they are suitable for metaphysical philosophical thinking and not for natural scientific research. Original Arab scientific creativity was based on a new scientific method combining reason and experience, and between induction and deduction, which was not known in ancient Greek thought.

I relied in this approach on the critical analytical method, because it is most appropriate to the nature of our research, which aims to show the truth of the philosophy of doubt in Arab science. We first highlighted the critical spirit of Arab scientific rationality in its treatment of ancient sciences, especially Greek natural sciences, then its methodological critical revolution against Greek deductive rational methods, including Aristotelian logic, and finally its scientific creativity at both the methodological and epistemological levels.

This attempt was not the first of its kind; many studies preceded it. I chose two of them: the first is a book by the thinker Roshdi Rashed, "Studies in the History and Philosophy of Arab Sciences," published by the Center for Arab Unity Studies, Beirut, Lebanon, 1st ed., 2011. He addressed the Arab scientific heritage in terms of subject and method, history and philosophy, and affirmed that research in it is still in its infancy, as its texts have rarely been critically edited. He showed that precise knowledge of the history of this human scientific heritage is necessary to understand the reality of classical science between the 9th and 17th centuries in particular, and to renew the history of global science in general. It aims to refute the doctrine of "Western belonging of science," because such subjective studies distorted the bright face of the history of scientific knowledge, and to understand the reality of Islamic civilization and culture in its scientific rational dimension.

The second study is also a book by Ali Sami Al-Nashar entitled "Research Methods among Muslim Thinkers," published by Dar Al-Nahda Al-Arabiyya, Beirut, 1984. He showed that Arab natural scientists did not rely on Greek deductive rational methods, especially Aristotelian logic, but rather deconstructed it and established in its place the inductive experimental method. While Arab Peripatetic philosophers such as Al-Farabi, Ibn Sina, and Ibn Rushd followed Aristotelian method and philosophy, Arab natural scientists such as Jabir ibn Hayyan, Al-Biruni, Ibn al-Haytham, and Al-Razi, etc., did not follow them, but adopted the inductive experimental method in all their research and were the true representatives of authentic Islamic thought. The aim of this study is to affirm that Islamic civilization is not merely a distorted image of Greek civilization, but an original civilization in its sciences and methods, and that Muslim scholars, despite their differences, attacked formal logic and deconstructed it, and established new methods suited to the nature of their research, expressing their distinctive culture that combines sense and reason.

1/ Arab scientific rationality as a revolution against Greek science: The Islamic Empire included many nations that possessed rich civilizations with sciences, arts, literature, and philosophies. They were connected to civilized nations they did not conquer, and "almost all

previous scientific heritage became available to them, in ancient Eastern civilizations and the Greek and Alexandrian heritage, to interact with their intellectual openness and rational tolerance and various factors in their dynamic civilization, and its genius from different peoples and ethnicities, so the most important stages of ancient science and its peak were formed through their remarkable innovations in various branches of science" (Al-Khouli, 2017, 37). Communication with the other is a historical fact and a civilizational and intellectual necessity. Islamic society was not closed upon itself, but open to others, encouraging freedom of scientific research and building bridges of communication with the other, because the sciences of earlier peoples were necessary for building a new civilization. Therefore, major scholars transferred the scientific heritage left by previous civilized nations into Arabic through the translation project in the 8th and 9th centuries CE, supported by political authority that provided all means for the success of this project. They gathered the essence of Eastern Indian and Persian scientific thought and Western Hellenistic heritage. Most Indian, Persian, Greek, Syriac, and Coptic works were translated… and this was a major scientific achievement in the history of science attributed to Arab scholars for continuing research (Rashed, 2011, 37).

But the history of science is the history of continuous correction of errors, and scientific truths are errors that have been corrected, as contemporary philosophers of science affirm. This requires critical thinking, and that is the most prominent feature of Arab scientific rationality. Ibn al-Haytham says: "The duty of the one who looks into scientific books, if his aim is to know the truth, is to make himself an opponent to everything he studies…" (Ibn al-Haytham, 1971, 04).

The critical spirit continued in Arab scientific thought until the decline of Islamic civilization. Criticism and meta-criticism were the foundation of the Arab scientific project. Arab scholars read ancient scientific heritage critically and realized the necessity of radical reform of Greek science and the need for a new scientific model. The 11th century witnessed many critiques of Ptolemaic astronomy, leading to innovative scientific projects that overthrew Greek astronomy (Saliba, 2011, 176).

Arab scholars realized that scientific truth is relative and not absolute, contrary to the Greek assumption. Ibn al-Haytham states that scientists are not infallible (Ibn al-Haytham, 1971, 03). He thus removed sacredness from scientific theories and warned against treating them as absolute truth, as science is dynamic and constantly evolving.

Scholars in the Islamic world maintained intellectual freedom based on philosophical doubt, which they considered the first stage of knowledge. Works such as "Doubts on Galen" by Al-Razi, "Doubts on Ptolemy" by Ibn al-Haytham, "Kitab al-Hay'a" by Al-Battani, "Refutation of Galen" by Ibn Rushd, "Correction of the Almagest" by Ibn Aflaḥ, "End of Inquiry in Correcting Principles" by Ibn al-Shatir, and "Refutation of Logicians" and "Refutation of Logic" by Ibn Taymiyyah… all confirm the critical scientific spirit of Arab scholars. Their doubts about Greek scientific authorities demonstrate the vitality and independence of Arab scientific thought.

This began in the 8th century CE with Jabir ibn Hayyan, passing through Al-Khwarizmi and Al-Razi in the 9th century, Ibn al-Haytham, Ibn Sina, and Al-Biruni in the 10th century, and astronomers such as Al-Battani, Ibn Aflaḥ, Nasir al-Din al-Tusi, Ghiyath al-Din al-Kashi, Ibn

al-Shatir, and Shams al-Din al-Khafri, and Ibn Khaldun in the 14th century as a model of critical scientific thought. Arab scientific rationality was a revolutionary critical rationality that undermined Greek science, corrected it, refuted it, and deconstructed many of its theories, and was not merely an explanatory rationality of Greek sciences.

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It is that the perception of truth passes through the mechanism of criticism and scrutiny rather than belief and submission. Arab scholars subjected the sciences of the ancients, especially the Greeks, to criticism and questioning, revealing their errors, contradictions, and weaknesses after exposing them to experimental tests. The leading figures of Greek science were not spared from the tools of criticism and scrutiny. Through reading and examining this heritage, they revealed its strengths and weaknesses and added a vast wealth of scientific facts that honestly revealed the reality of their conscious experimental scientific studies (Al-Tawil, 1974, pp. 268). The Arab scientific trend questioned Greek unscientific theories, considering them philosophical approaches to nature based on abstract rational inference, which constrained thought and restricted its progress for centuries, and subjected them to review and questioning. This began early in the eighth century AD with Jabir ibn Hayyan, who raised strong doubts about Greek scientific figures, including Galen, and founded chemistry after destroying many unscientific Greek ideas, including the views of the First Teacher. He refuted Aristotle's theory on (the formation of metals) and demonstrated its contradictions after subjecting it to experimentation (Muntasir, 2012, p. 105). This opened the way for later Arab scientists to practice criticism and scientific refutation. Al-Kindi (d. 873 AD) invalidated many of Aristotle's views and old theories that contradicted scientific discourse, such as the idea of transforming base metals into gold or the influence of planets on human conditions (Muntasir, 2012, p. 108). Al-Razi (d. 925 AD) also criticized Greek scientific figures including Aristotle, Euclid, Proclus, and Galen, saying: "The craft of medicine and philosophy does not tolerate submission to authorities, nor accepting them without scrutiny, nor neglecting thorough investigation; nor does the philosopher approve such behavior from his students" (Al-Razi, 2005, p. 12).

Ibn al-Nafis (1288), author of *Al-Mujaz* in medicine, revealed and criticized Galen's errors and presented the theory of pulmonary circulation three centuries before Servetus and Harvey. He affirmed that Galen speaks of truths while dissection contradicts him. He took pride in his empirical experience and considered it the primary source of truth. When experience revealed a scientific fact, he recorded it, commenting: "It does not matter whether it agrees with or contradicts the opinion of those who preceded us" (Al-Tawil, 1973, p. 162).

In physics, Ibn al-Haytham refuted Greek theories based on rational deduction and overturned them completely, as they did not withstand his experiments. He exposed the contradictions of Ptolemy in his major works *Al-Majisti*, *Al-Manazir*, and *Al-Iqtisad*, saying: "Ptolemy has many errors in many places in his books. For example, his discourse in the Almagest, upon careful examination, contains many contradictions, as he establishes principles for the structures he describes and then presents configurations of motions that contradict those principles... He also has errors in *Optics*, including a flaw in the proof regarding the shape of mirrors, which

indicates weakness in his understanding. As for *Al-Iqtisad*, the meanings he presented in the second article and the structures he established regarding circles and projections, upon examination, most of them are invalid and collapse" (Ibn al-Haytham, 1979, pp. 206–207).

Scientific generations then continued testing, correcting, and refuting Greek astronomical theories, paving the way for the modern scientific revolution. This is evident in Nasir al-Din al-Tusi (d. 1274), who built the Maragha observatory in 1259 and authored *Al-Tadhkira fi Ilm al-Hay'a*, al-Battani (13th century) in *Kitab al-Hay'a*, Ghiyath al-Din al-Kashi (1412) in *Zij al-Khani*, Ibn al-Shatir (d. 1375), Shams al-Din al-Khafri (d. 1550), and others, whose revolution against Greek astronomy was a necessary prelude to the modern Copernican revolution. Criticism and meta-criticism were the dominant feature of Arab scientific thought, and this is the logic of continuously evolving scientific inquiry. Rashdi Rashed says: "This science was revolutionary from beginning to end and in all its domains" (Rashed, 2011, p. 40). All of this confirms the strong and effective presence of Arab scientific rationality in building human scientific heritage.

Islamic scientific spirit differed radically from the Greek one. The latter considered knowledge an end in itself, unrelated to material or practical benefit, whereas Arab scholars considered scientific knowledge the best means for serving life and solving its problems, since understanding natural laws enables humans to control and harness nature for human benefit, which is part of the meaning of vicegerency and the development of the earth. This contrasts with the Greeks, who knew mathematics and reached near perfection in it but did not use it to solve their real problems (Zakaria, 1978, pp. 121–122). The Greeks separated mathematics from natural sciences and preferred the former, as it studies a necessary and fixed world, while the latter studies a possible and changing reality. Arab scholars, however, used mathematics alongside experimental methods, and the integration of mathematics and physics is clearly evident in Ibn al-Haytham's work, who confirmed that light cannot be scientifically studied without combining physics and mathematics, thus completely breaking with the Greek scientific tradition of Euclid and Ptolemy (Rashed, 2011, p. 306). Thus, Arab scientific rationality was a true scientific revolution that corrected, refuted, and surpassed many old theories and moved beyond the Greek scientific model, advancing science significantly.

2. Arab Scientific Rationality as a Methodological Revolution

Scientific crises are caused by the inability of old methods to keep up with continuous scientific development. Corrupt methods kill scientific creativity, while sound methods promote it (Bernard, 2005, pp. 34–35). Arab scholars realized the inadequacy and limitations of Greek deductive methods in understanding natural phenomena. Ibn al-Haytham says: "I examined various opinions and beliefs and different types of religious sciences, but I gained no benefit from any of them, nor did I find a path to truth or a clear route to certainty. So I realized that I can only reach truth through opinions whose substance is sensory matters and whose form is rational matters" (Ibn Abi Usaybi'a, 1995, pp. 91–92). Thus, for him, the scientific method must combine experiment and reason, which is the foundation of the modern scientific method. When Arab scholars questioned Aristotelian logic—whether it is a universal law necessary for every mind seeking truth—the vast majority rejected it. They dismantled it and developed

innovative scientific methods suited to their fields (Al-Nashar, 1984, p. 351). They also recognized that it was based on Greek linguistic structures different from Arabic and tied to Greek metaphysics incompatible with Islamic doctrine (Al-Nashar, 1984, pp. 10–11).

They also realized, centuries before Europeans, that Aristotelian logic was sterile and merely redundant, useful mainly in debate and argumentation rather than scientific discovery (Ibn Taymiyyah, 2005, p. 361). It moves from general universals to particulars, which is problematic, since deducing particulars from universals is deducing the unknown from the known (Ibn Taymiyyah, 2005, p. 372). Knowledge of natural phenomena begins with sensory particulars and moves toward abstract universals, meaning that knowledge of the concrete precedes the abstract (Ibn Taymiyyah, 2005, p. 372).

Arab scholars understood that the nature of the subject determines the method, and that no single method is suitable for all sciences. Deductive Greek methods are suitable for formal sciences but not for natural phenomena. Thus, analytical rational methods became tools for abstract thought, while inductive experimental methods were preferred for material reality (Al-Razi, 2005, p. 10).

Through this precise methodological critique, Islamic scholars revealed the fragility of Aristotelian logic, liberated the mind from its constraints, and shifted scientific inquiry from abstraction to experimentation. Jabir ibn Hayyan, Ibn al-Haytham, al-Biruni, al-Razi, Ibn Sina, al-Zahrawi, and others laid the foundations of experimental-inductive science before Europeans discovered it (Al-Kubaisi, 2009, p. 33). This was a major intellectual achievement that transformed human thought and freed reason from formal logic.

Experiment became the source and criterion of scientific truth. Jabir ibn Hayyan emphasized that science is not based on contemplation but on experimentation, saying: “Whoever knows its balance knows everything within it... and experience reveals it. Whoever does not experiment achieves nothing” (Jabir, 2006, p. 427). Al-Razi also insisted that medicine is an experimental science, not a deductive one, unlike Galen, who confused deductive and inductive methods (Al-Razi, 2005, p. 20).

Conclusion:

Therefore, Arab natural sciences were not Greek sciences formulated in the Arabic language, but rather a scientific model different from the Greek model, which is incompatible with scientific discourse and comes very close to the modern scientific model. Arab scholars gathered the essence of ancient scientific thought, including Greek science, and subjected it to questioning, revision, and criticism. They corrected, amended, and refuted every scientific theory that did not withstand their experimental tests, without considering the fame or scientific status of its proponents. They then moved to the stage of construction and methodological and epistemological foundation. Among their greatest scientific achievements was the discovery of the inductive experimental method during their experimental scientific research, in which they combined reason and experiment, induction and deduction, and mathematics and natural sciences, something that the Greek mind had not previously known. This was a great revolutionary transformation in the history of thought and a preparation for the modern scientific renaissance in Europe.

Today, we need to understand the true nature of the critical and creative Arab scientific spirit in order to draw inspiration from it for scientific research, with the aim of reviving a scientific renaissance that would take us out of underdevelopment and into civilizational competition. We also need to reread our scientific heritage with an accurate and objective scientific reading, as it is the best expression of the greatness of Islamic civilization.

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