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Back to progress: One or more scientific paradigms

Abstract

The 17th century is the final period of the existence of the pluralism of scientific paradigms, alchemical and mechanical, which simultaneously opposed and complemented each other. In such an unrestrained competition of paradigms the European mind rapidly progressed, enabling a more diverse comprehension of the world. In the 17th century there is still an epistemological balance between tradition and progress, closely allied with both the historical continuity and utopian expectations. However, in subsequent centuries, instead of secular balance, a mechanical paradigm has prevailed. Reductive interpretations of the key 17th century scientific figures had overwhelmed and inaugurated new hermeneutics of progress which set up science as a prime mover of cultural changes.

The aim of this paper is to propose reconsidering of the 17th century epistemological pluralism in order to balance mechanical paradigm, enervated by the subject — object polarization, with alchemical paradigm, based on the notions of transmutation of elements, mind-related experiment and symbolic language. Coupled-paradigm approach could sharpen onward meaning of the scientific progress and contribute to the better understanding of the problem of linguistic and biological diversity dynamics.

Key words:
Mechanical paradigm, alchemy, 17 century, scientific revolution, biodiversity, linguistic diversity.

THE CONTEMPORARY SCIENCE is usually considered to be founded on the set of cognitive and heuristic principles and experimental results formulated mainly in the 17th century. That century represents the turning point in the development of the entire modern scientific knowledge, since the traditional European science, with its epistemological procedure founded on the Antique and Renaissance classics, had been abandoned in new cognitive and methodological procedures.

The new enlightened knowledge, which establishes clear and distinct principles of scientific comprehension of the world, has several crucial points, rationalism being the most important among them. On that ground partition from the tradition was justified and accomplished; knowledge as revelation of secrets of great teachers was rejected and the idea of impersonal methodological science was strongly emphasized.

According to the methodological significance, Descartes' dissociation of *res cognitans* from *res extensa* is the deceive course in that process, which definitely polarized subject and object. As an attempt of a systematical philosophical interpretation, this polarization replaced the habitual epistemological approach and supported rational diversification of the scientific research. It was assumed that subject and object could be studied autonomously and that the objects of study could be further reduced into parts. Holding such an opinion Descartes concluded that the real science had to be limited to the mathematical investigation of the motion of the objects only. That was the corner stone for the philosophical completion of the building of the new *philosophia mechanica*, often named *the mechanical paradigm*.

Bacon, Galileo, and Newton also contributed to the establishment of mechanical science: Bacon with ideas of induction and common sense, Galileo with his experimental method, and Newton with his persuasive operationalization of the dynamics of nature, relied on linearity, determinism, time-reversibility and causality. From all these methodical and cognitive insights a possibility of interpretation of the world in a new frame was born. That frame confirms the mechanical science as the turning point

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of the abandonment of old lore and acceptance of the new, enlightened knowledge, committed to the empirical, experimental, common-sensed, clear and distinct methodological approach. Science was to provide the new worldview and wanted to look for truth and certainty using its own rationally based method. Going this way science came to be taken as a fact, and over time was forgotten that this new truth system also had a history and assumptions.

Subsequent centuries increasingly emphasized the turning character of the 17th century and regard it as a radical separation from the previous scientific heritage. This detachment is often conceived as the scientific revolution, which reversed completely the comprehension of the scientific task and its method. Even in the 20th century many theoreticians of science, e.g. Thomas Kuhn, continue to speak about the 17th century as the first real scientific revolution, abandoning of the previous and commencement of the next scientific epistemology. Moreover, Kuhn considers the previous science as the "preparadigmatic period", expressing indirectly the rejection of its content.[1] Also the British historian Herbert Butterfield proclaimed that the so called scientific revolution, popularly associated with the 16th and 17th centuries ... outshines everything since the rise of Christianity and reduces the Renaissance and Reformation to the rank of mere episodes, mere internal displacements within the system of Medieval Christendom.[2]

In accordance with these beliefs, scientific progress in previous three centuries maintained its strongly emphasized revolutionary legitimacy. It insisted on such a legitimacy, which accents the turning mettle of the new scientific results and denies all the main aspects of tradition: both rational Aristotelianism and hermetic Neoplatonism. This denial resulted in a number of important new methodological and practical discoveries in the scientific comprehension of the world. However, from the point of view of the history of science, at the same time that led to some intrinsic problems. The attentive comprehension of the scientific heritage was in the 18th century replaced with revolutionary excitement, making vague teleological questions of value and sense, essential for every cognitive process. These questions are postponed behind the urgent goals directed towards "conquering of nature" and "revelations of its secrets". In subsequent centuries they are almost entirely abandoned as unnecessary and inadequate to increase the efficiency of mechanical science.

The scientific progress was in this way accelerated, but acceleration was obtained at the cost of rejection of centuries and millennia long cognitive efforts. As a consequence, in the mechanical philosophy prevailed the concept of autarchic efficiency, which, until recently, does not allow the scientific knowledge to reach real historical self-consciousness. The main problem lies in the fact that the mechanical paradigm, when the development of the scientific knowledge is observed in a longer period, seemingly interrupted and broke out the continuity of the scientific world. That paradigm in all the main aspects recognized itself as the break off with tradition, the victory of true science over the obscure, false knowledge, resolutely stressing non-authenticity and inefficiency of heritage. Instead of secular epistemological unity, the emphasis is put on the division and discreteness, as well as the suppression of the traditional apprehension from the active horizon of contemporary science and technology.

Such a revolutionary image of scientific progress is obviously loaded with one-sidedness and it does not reflect the real scientific content of the 17th century. This century represents a period of an equal upraise and development of both mechanical and alchemical thought. It seems certain that alchemy was the most flourishing laboratory tradition to exist before scientific revolution and probably the strongest laboratory tradition ever to exist anywhere in a non-institutionalized form.[3] Furthermore, Neoplatonic natural philosophy came in the 17th century to offer a clean and well-developed general alternative to decaying Aristotelianism and rising mechanism.[4] The very essence of traditional knowledge in the 17th century expresses itself as the alchemical paradigm, comprising the Neoplatonic natural philosophy and Aristotelian phenomenological and qualitative method.

Revolutionary image of the science of the Enlightenment ignores also the fact that all the main concepts of mechanical sciences existed before the 17th century. Alchemy was neither denied by the empirism of the new science, because it draws its empirism from Aristotelianism, nor by the idea of

[1] Thomas T. Kuhn, *The Structure of Scientific Revolution* (Chicago: The University of Chicago Press, 1964), p.10.

[2] Herbert Butterfield, *The Origins of Modern Science 1300-1800* (The Free Press, 1957), p 7.

[3] B.J.T. Dobbs, *The Foundations of Newton's Alchemy* (Cambridge: Cambridge University Press, 1984), p. 64.

[4] *Ibid*, p. 36.

the natural law, because it relies on the Neoplatonistic order. It is not even denied by the experimental method, since the experiments were performed every day. Only the context is new and the interpretation is different: instead symbolic and qualitative it is now conceptual and quantitative. In this new frame rational revolution became the prime mover of social forcing which linked revolution of the reality with the scientific progress. Moreover, revolution and progress became synonyms and the science their main driver.

But after centuries of fervid uplift it seems now that a question might be raised, whether development of mechanical paradigm contains the whole meaning of the progress. Reason for that is that the world became a fragmented mechanical composition, consisting at least of two parts: matter and spirit, which neither transmute one into another nor correspond in any essential way. In fact, from Descartes and his first cognitive machine, which produces *esse* through *cogito*, to numerous subsequent machines created in industrial, informatic and other revolutions, science has been forced to look for a method of keeping together the mechanically divided world. A machine is embodied revolution, because the world has to be created continuously; the immediate presence of the world disappeared and continuous efforts have to be done to interpret and unite it through various concepts. The Cartesian cognitive machine, regardless of the proclaimed goals, even today, creates fragmentation as its real product, division of the world into parts, separation of man from the world.

We must notice that the new mechanical principles were neither created *ex nihilo* nor through an ingenious intuition, as the following centuries used to present, but as a result of the lasting speculative insights and experimental labour within the precedent paradigm. The recent appearance of Newton's alchemical manuscripts, which for a long time were inaccessible to the scientific public, made this statement especially convincing. It is also important that they witness that the greatest part of Newton's scientific activity was dedicated to alchemy, study of contemporary alchemical authors and their antique origins. In his very well equipped alchemical laboratory he performed a great number of experiments, successful in many aspects, at last as source of inspiration for mechanical reinterpretation of alchemical concepts. He became so captivated by alchemical way of imagining and comprehension, that he found himself l wanting to revive an alchemical knowledge.

Not only Newton, but before him Bacon, who gave the strongest urge for the replacement of Aristotle's organon by a new one, investigated within the frames of the alchemical paradigm. As for Bacon, there can be no doubt that he was familiar with alchemical literature. Although he criticized the alchemists on some occasions and significantly modified their ideas at other times, still many of the tenets of his natural philosophy had been derived from them, and he presented his own suggestions for the maturation of other metals into gold.[5] Bacon did not see essential opposition between alchemical and his organon, since the alchemical organon also was empirical and inductive to a great extent.

Bacon and Newton, and besides them many others, for instance Locke and Boyle, were striving to the same goal: not to contest the ancient science in a revolutionary manner, but to aggregate the alchemical ideas into the new-born mechanical philosophy. Contrary to the customary opinion almost all the prominent thinkers of the scientific revolution rely upon both paradigms. They did not found their science rejecting the alchemical paradigm, but they developed the mechanical science starting from the new comprehension of alchemical contents and their translation into the conceptual system of the mechanical paradigm. As a consequence of later interpretations, both groundless and burdened with prejudices, this important cognition was suppressed and lost. In fact, alchemical and mechanical sciences are not developed in a contradiction but in synchronicity, and their contraposition is a result of ideological intentions, insufficient intellectual capacity and misunderstandings during the past centuries.

Hence we have to agree with A. G. Debus, who was the first to initiate these questions within the context of the history of science. He points that it is becoming increasingly more evident that major personalities as well as basic scientific concepts associated with the Scientific Revolution have their roots in the mystical Neo-Platonic cosmology.[6]

[5] *Ibid*, p. 59.

[6] A.G. Debus, "Alchemy and the Historian of Science", *History of Science*, vol. 6 (Cambridge University Press, 1967), p. 130.

> If we ignore the 'pseudoscience' of the sixteenth and seventeenth centuries we may be making key figures and key concepts difficult to understand.[7]

The misunderstandings are reflected in the inadequate interpretation of the 17th century science and its forced "mechanization", i.e. dualistic reduction of phenomena to mere objective or mere subjective facts. Enthusiastic simplifications resulting from such a reduction contributed significantly to hinder the science to continue its development in the direction indicated by the greatest minds of the 17th century. For example, Newton never recognized gravity as a 'physical' force. He always spoke and many times was repeating that it is only a 'mathematical' entity, and that it is entirely impossible to perform an action in the absence of an active force ... However, the first generation of his pupils accepted the force of gravity as a real physical, even essential property of matter.[8] This is also one of the tracks witnessing that Newton subtly relies his theory of gravitational attraction upon the sense of alchemical concepts of affinity, although he ascribes a clear mechanical interpretation to it. The subsequent loss of the sensitivity for such a fine distinction is an additional consequence of the revolutionary paradigm.

Also many subtle differences and definitions, which could not have been discerned in the generic optics of the pure mechanical paradigm, had been lost in development of the modern science. Dismemberment of the cognitive horizon led directly to dogmatization and formation of new misconceptions. One of the greatest was the assertion about impossibility of transmutation, in spite of Newton's position that nature performs it regularly. In this sense, the crucial attempt of the mechanical revolution was in fact apology of non-transmutable, divided world and establishment of a universal science where matter and spirit as well as all the elements are definitively separated and incapable for any type of transmutation. The concept of transmutation is the substantial difference between the mechanical and alchemical paradigm. Contrary to the one-sided mechanical philosophy, Newton was capable to accept transmutation, because his science was both mechanical and alchemical. Exactly from the standpoint of rejection of transmutation, the mechanical philosophy strenuously disputed alchemy and labelled it as an occult science. Nowadays is generally accepted that transmutation, as Newton pointed, not only occurs in nature continuously but is also technologically possible.

Alchemy also brought the conscious mind into the process of examination and stressed the role of a conscious observer in the scientific process, as the quantum mechanics now suggests that the wave function collapses when the observer reads the measuring instrument. The dependence of the experiment on the observer, as the alchemy early indicated, carried to the demand for the ethic of scientific knowledge. This claim lies in the nucleus of the alchemical paradigm, in its search for "the symbolic correspondences between alchemical work and the process of spiritual salvation".[9] Alchemy was opposed to the *philosophia mechanica* effort to replace Natural with Artificial and to affirm predominance of the later. It speaks in this context about

> the Archons (which) try to hide from man knowledge of his divine spirit. To this end they introduce into man their own 'counterfeit spirit' (antimon pneuma), which causes man to become forgetful and binds him to the worlds of matter and Fate.[10]

Many other arguments in favour of reconsideration of the alchemical method could also be presented, demonstrating that the mechanical science came by itself to the very same conclusions previously disproved within the alchemical paradigm. Therefore it is possible to conclude that the alchemical paradigm was founded on correct principles which enabled consistent comprehension of the nature and the world. It is a mere misconception to believe that the mechanical paradigm had prevailed as if it were more accurate and efficient. It is closer to the truth that mechanical paradigm only overpowered its opponent. It took over by force, not by argument. Alchemy simply placed things in a wider casual context unattainable to the contemporary mechanical science.

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[7] *Ibid*, p. 131

[8] Alexandre Kojeve, *Etudes newtoniennes* (Paris: Gallimard, 1968).

[9] Daniel Stolzenberg, "Unpropitious Tinctures", *Archives internationales d'histoire des sciences*, vol. 49, no. 142-1999, p. 29

[10] *Ibid*, p. 27

Although the chemical aspect of alchemy was abjured, it has reappeared, for example, as the symbolic archetype psychology of Carl Gustav Jung. Possibility of this reappearance illustrates the bias in overlooking of the relevance of the cognitive experience contained in the alchemical paradigm. In this context we should also consider the development of symbolic logic and mathematics in the 20th century, which parallels the development of symbolic psychology. These new approaches try to reverse the path of mechanical sciences, which is tuned to reach the basic elements through continuous fragmentation and diminution of the subjects of their investigations. Thereby we could not avoid reconsidering the relation between the new mechanical and the alternative alchemical paradigm. Not only because the basic alchemical assumption of transmutation has been proven to be correct, and the mechanical denial of this postulate erroneous, but because the real scientific progress has to be recovered where it was essentially lost, i.e. in the 17th century.

In that century we still have an epistemological continuity, closely allied with the secular tradition, but in the 18th century (and after) we have ideologies which actually produce revolution through reductive misinterpretation of the key 17th century's scientific figures. At that way, revolution from the social field was "exported" into the realm of science and alchemy was dethroned together with the political *ancien régime*. "Although d'Alambert mentioned the great battle between the ancients and the moderns, it is clear that he thought that the battle was essentially over and that the moderns had won." [11] Result of this victory was that "the scientist was being carefully moulded into a new type of cultural hero... attributed the moral virtues of the idealized Stoic philosopher to recently deceased natural philosopher." [12] Therefore, it is not a lack of efficiency that led to the rejection of alchemy, but urgent ideological need of establishing "new science" for "new society".

The 17th century is in fact the ultimate period of the existence of the pluralism of scientific paradigms, which simultaneously opposed and complemented each other. In such an unrestrained competition of paradigms the science was rapidly advancing, enabling a more profound comprehension of the world and preventing transformation of science into self-sufficient technology. Unfortunately, in centuries to come, instead of preservation of that conceptual dynamics, the mechanical exclusivity has been glorified. In order to maintain its revolutionary legitimacy, established on the refutation of the alchemical epistemology, the mechanical paradigm has designed the concept of progress as a continuous separation from obscure alchemical delusions and perpetual increase of the true efficient knowledge. However, neither the science might be justified by its progress, since progress can also be realized on false presumptions (*ex falso quod libet*) nor its progress could be rationalized by the efficiency attained, since within the frames of the sole category of efficiency it is impossible to distinguish construction from destruction, both of them being the fruit of efficiency. If we consider the mechanical paradigm more efficient than the alchemical, then we are forced to define the concept of efficiency very restrictively as the mere manipulation with objects. Alchemy, trying to find different kind of efficiency which comprises both the subject and the object, certainly pursued a much broader and a more profound task, which is not yet solved, but simply abandoned.

Now we are closer to the appropriate question — revival of the buried ancient science, is it possible, not as mere historical phenomenon, but as the chance of seeing our present scientific problems from the fecund perspective? May we say that progress now needs us to turn ourselves backward? Where exactly lays the setback which invokes restitution of the ancient alchemical paradigm? Basic difficulty is that different names are given to the same phenomena in the different domains of perception. This is critical point of the mechanical paradigm because it fails to recognize the same process occurred at different, mechanically separated levels. Dispersion of the cognitive process is obvious the most in the understanding of process of bio-cultural extinctions which characterizes the modern world. Extinction now seems to have at least two levels which correspond to the mechanical paradigm domains of object and subject. First level is evident as the global threat to biodiversity with current extinction rates of living species well above background scale. It is already lost one million species, and several more million will be probably lost in the first few decades of the 21st century. Whereas the natural rate of extinction is estimated at about one species per year, the present rate is estimated at 10,000 times that — about one per hour — and almost all of these losses are caused by human

[11] B. J. Dobbs, "Newton as Final Cause and First Mover", *Isis*, vol 85, no. 4, dec. 1994, p. 643.

[12] *Ibid.*

activities.[13] Second is connected to the human languages which also become extinct or threatened with extinction. It is known that half the 6,000 or so languages spoken in the world would cease to be uttered within a century. From another side, 52% of the world's population speak one of just 20 languages.[14]

A number of researchers suggest that there is correlation between biological and linguistic diversity. Areas with high language diversity have high bird and mammal diversity and all three show similar relationship to area, latitude, area of forest and, for languages and birds, maximum altitude.[15] Although similar factors explain the diversity of languages and biodiversity, and surprising similarities of the different domains of extinction are clear and well documented, an attempt of cohesive interpretation of the both processes is not possible within the frame of existing mechanical paradigm. From the mechanical point of view it is not possible to see the same root of the both processes and to merge divided domains. Practically, due to the mechanical paradigm apology of the subject — object bifurcation the same process has gotten two names depending of the level of perception.

Mechanical paradigm always redirects understanding to the two separate domains: subjective and objective, cultural and natural. Therefore, diversity is studied from a dualistic point of view and such a paradigmatic aberration gives an impression of the two separate entities which should be investigated apart. Maybe it seems as a better resolution of scientific optics, but in fact it is the loss of ability to link obviously synchronized phenomena. This linking, or in alchemical words that Newton liked — affinity, is the heritage of the alchemical paradigm which has been lost in the previous centuries. Cartesian viewpoint that relies on rational separation of natural and cultural world is incapable to grasp the solution of the diversity problem. Instead of that it makes problem more complex and interminable.

If we consider what might be a real scientific progress, not bare perfection of technological instruments, we should address ourselves to the neglected alchemical paradigm and try to make coupled paradigm array which assembles mechanical and simbolistic, transmutable, subject — object synchronized approach. That way could open genuine, non-revolutionary scientific progress, because alchemy is much closer to the mechanical science that one would expect from previous historical discussions. Science of future should have access to a variety of paradigmatic assumptions to facilitate decomposition of the intrinsic scientific partitions and to inspire us for better insights into our world. The diversity of paradigms is the ultimate ground for rescue of the both natural and cultural diversity.

It is very hard to conceive further scientific progress guided by the mechanical paradigm only. It has reached its epistemological limits which could not be extended by intensive multiplication of scientific fields and improvement of technological devices. Revolutionary exclusivity should be balanced by the pluralism of paradigms which can strengthen scientific capacity to better conceive its cogency. That coupled-paradigms science, instead of mono-paradigm approach, could give decisive contribution to the building of the sustainable world.

[13] Groombridge, B. Jenkins, M, *World Atlas of Biodiversity: Earth's Living Resources in the 21st Century* (University of California Press, 2002).

[14] Wurm, S. A., *Atlas of the World's languages in Danger of Disappearing* (Paris – Canbera: UNESCO Pacific Publishing, 1996).

[15] William Sutherland, "Parallel extinction risk and global distribution of languages and species", *Nature*, vol. 423, p. 276 – 279 (15 May 2003).