

The Educational Utilization of Elements of the History of Natural Sciences (19th century): Highlighting the Cognitive Continuity with Antiquity

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Abstract. In the current paper, the reasons why the late 19th century Greek university community of natural scientists used elements from the History of Natural sciences which refer exclusively to ancient Greek science, and the consequences of such a choice are evaluated. Emphasis will be given to the speech delivered by the Dean, Professor of Chemistry, A. K. Hristomanos, entitled “Natural Sciences and Progress”, at the National University on 17th of December 1896, where, without nullifying the Scientific Revolution of the Modern Period, he attempted the analysis of its cognitive continuity with antiquity and the authority of the ancestral past. Hristomanos’ name was linked to almost all the attempts at reforming and spreading natural sciences in the late 19th century, and from this point of view his speech, and the way in which it is structured, become a reliable indicator in tracing theses and viewpoints within the entirety of the scientific community of natural scientists.

1. Introduction

From the beginning of its scientific life, around mid 19th century, the Greek university community of natural scientists realized that its main concern should be the social and linguistic upgrading of its object of study. This seems difficult, considering that the entire educational system was supporting the classical theoretic studies, which were considered to be the bearers of the historical past and contributed to the ideological construction of the national profile of the modern Greece.

The question is how the natural sciences, which were considered alien to the purpose of a humanitarian education, could be incorporated in the programs of studies, so as their contents would be in harmony with traditional functions of the educational system.

The present work investigates the way in which the Greek community of natural scientists in the late 19th century exploited elements from the History of Natural Sciences that referred to the ancient Greek science model. The

objectives of the community were not only the efficient teaching and the easier understanding of the related topics, but mainly the smooth incorporation of their teaching into the basic structures of the humanitarian education.

Emphasis will be given to the speech delivered by the Dean, Professor of Chemistry, A. K. Hristomanos, entitled “Natural Sciences and Progress”, at the National University on 17th of December 1896, where, without nullifying the Scientific Revolution of the Modern Period, he attempted the analysis of its cognitive continuity with antiquity and the authority of the ancestral past. Hristomanos’ name was linked to almost all the attempts at reforming and spreading natural sciences in the late 19th century, and from this point of view his speech, and the way in which it is structured, become a reliable indicator in tracing theses and viewpoints within the entirety of the scientific community of natural scientists.

Thus, although the members of the community are in cognitive conduct with the academic environments in central Europe, where spectacular scientific developments take place, it can be seen a circumspection in their willingness to abandon the old and accept the new. As a result, a local scientific climate with particularities and peculiarities was developed.

This deduction supports the point that science is not a product of constant power and invariable character, but its apperception is a very complex cultural process, which is adapted to the local cultural data. Space, time, and cultural particularities can play a significant role in the formation of the scientific language. From this point of view, the study of cases like Hristomanos’ one, brings out also that the ideological orientation of the scientists, their cultural environment, and their philosophic beliefs affect the formation of the characteristics of the phenomenon of science, by involving in the field of study of historic evolution of sciences some extraneous factors as well, namely social, cultural, and ideological factors.

2. The Speech Structure

The speech is made up of four parts, while the two poles around which its arguments revolve are the concept of Progress on one hand and Natural Sciences on the other. The ulterior goal of the speaker is to connect Progress, the growth and well-being of the nation, to the spreading and propelling of the Natural Sciences.

Hristomanos began his speech by analyzing the concept of Progress, by expressing a thesis favored in the intellectual trend of the time, that the conception and cognizance of the historic continuity of the Greeks, the recognition of the greatness of the inheritance of the “resplendent ancestors” and the love of country, constitute serious reasons for which “it is impossible

that we decline and regress [as a Nation]” (Hristomanos 1898, p. 4). On the contrary, they are the motives for the triumph and progress of the Greeks.

In the second and longer part of his speech, he referred to a rich and impressive, for that time, selection of scientific achievements which led to progress, in order to support the rationale according to which it is a proven fact that the promotion of natural sciences through their European model of development and the practical implementation of scientific achievements improve people’s quality of life and ensure economic affluence. At this point, the way Hristomanos over-stressed the historic element of his argument so as to bring forth the ideology of the authenticity of the ancestors was particularly interesting, for reasons which we shall analyze later on.

The third part of the speech moved on exactly the same axis as the second part, while giving emphasis to the science of Chemistry, its achievements and the broad spectrum of their application. In the fourth part the perspective that the “the progress of our country and its auspicious future depend on the performance of natural sciences” (Hristomanos 1898, p. 34) was stated almost as an axiom.

3. References to the History of Ancient Science

In the same year that Hristomanos’ speech had been delivered, in the high-school of Mytilene, M. K. Stefanides, who had studied natural sciences and in 1893 was announced “Doctor of philosophy of Natural Sciences”, attempted to teach basic subjects from the History of Natural Sciences. For Stefanides, the historic teaching of Natural Sciences contributed a lot to the easier comprehension of relative matters by the student and in parallel, restored the unacknowledged ancient Greek science (Stefanides 1938). However, this is an isolated initiative, which we should consider concerns the high-school in which Stefanides was serving in particular, and it does not reflect any general attempt of reforming. As the teaching of the subject of History of Natural Sciences was established in the University in 1924 with Stefanides in the corresponding department, we must accept that in the period we are investigating, the community of natural scientists examined *only elements* of the History of Natural Sciences, without actually recognizing it as a separate object of study.

Let us return to those points in the speech where the reference to the History of Ancient Science was not merely a historical method for approaching scientific matters on the basis of their evolution, but it was also aiming at the reconstruction of a scientific tradition which utilizes the scientific findings of the ancestors and links them to the innovations and achievements of contemporary scientific activity.

Matter constitutes the central concept, and references to the related theories orientate the historical perspective accordingly. For that reason “the explanation of the function of natural forces and the constitution of matter through the atomic theory, which penetrates all natural sciences” (Hristomanos 1898, p. 16–17), constitutes in its essence a redraft of concepts already known from ancient Greek science, since “Leukipos, Demokritos, Aristotle, Epicouros, Anaxagoras and Embedoklis first foresaw that matter [...] is constituted of minute parts called *atoms*” (p. 17), invisible to us, which it is not possible to further reduce in size or to split, Hristomanos, without doubting the science of the New Ages placed it on the base of ancient classical theories, as he later mentions that “after them [the ancients], in the beginning of the current century, the English naturalist Dalton discovered the experimental basis of this theory [...], and later the Italians Avogadro, Kirchoff and Causius validated the status of the existence of atoms through infallible mathematical check” (p. 17).

Continuing, he refers to Embedoklis, who was the first to define ‘element’ in the sense of the material which the seventy-one “currently known elements” (p. 17) are made of, as well as to Aristotle, who was the first to speak about the ‘homoiomers’, what today’s science calls molecules: “. . . the science of the 19th century discovered that molecules actually exist, after Aristotle recognized this twenty-three centuries ago and based thereon all his explanations about every action in nature. Twenty-three centuries had to pass for the great importance of the theory of the Stageirite [Aristotle] to be comprehended and valued by modern science”.

The inaugural speech of Hristomanos, which was given in May 1864 in the University, is particularly interesting in view of the matters we are discussing. It consists of a complete retrospect of the History of Natural Sciences, emphasizing on the example of ancient Greek science. The extensive report to the Ionian philosophers, Pythagoras, Herakleitos, Embedoklis, Democretos, Socrates and Plato, and mainly Aristotle, signifies the scientific and philosophical profile of the professor. On the other hand, it consists of a typical ‘writing’ style of the way of negotiating relative subjects, to which the Greeks had reached, taking as a fact that Hristomanos had been called upon in 1862 by the Greek government “to support the national work of reorganizing the teaching of natural sciences”, and so he is the typical case of a Greek natural scientist (Hristomanos 1864; Germanos 1896).

So, has modern science nothing new to present? Is it merely a reconstruction of theories already known from ancient Greek science? Hristomanos did not suggest anything of the sort; he is an admirer of the European model of scientific progress himself, praising the contemporary scientific achievements and suggesting their practical application in order for the country to be led towards progress, as would certainly happen in all advanced countries in Europe.

On the other hand, the dominant traditional cultural environment made natural sciences a side issue, consolidating the belief that they were alien to the purpose of a humanitarian education based on the glorious ancestral past, which would shape the national character of Modern Greece. Therefore, the advantage was on the side of the classical, theoretical sciences, which were the bearers of the historical past and had a big share of participation in the ideological construction of the national profile of the new state.¹

Greek antiquity, the glorious past, the tendency towards archaism, reflected the efforts to achieve immediate linking to the greatest possible degree of the ancient Greek world and modern Hellenism as its historic heir. The quest for the idealized past, mainly its ancient Greek component, the nostalgia and the vision of a future different from the present, the constantly refueled struggle for the realization of a national ideal, all these things comprise stereotypical characteristics of the nationalistic ideology which is being shaped. In the frame of this approach, the present and the future exist as a reflection of the idealized past, which means that Greece has a duty to express the eternal quality of the unaltered classical ideals. Thus, if the building of the historic past and the ideological reconstruction of a national identity constituted the basic characteristics of any new nationalism, the Greek past was undoubtedly over-emphasised more than in any other place. The domination of classicism as the ideological starting point resulted unavoidably in the over-stressing of the value of ancient Greek civilization, in the unbounded re-use of its 'sources' and, mainly, in the extremely intense orientation of the educational system toward classical subjects, to the detriment, naturally, of science and technical skills. This leading role of classical education stated that *the educational mechanisms had to be established not on the development of their relationship to nature and the natural forces, but on the basis of a mentality, which would be loyal to national traditions*. From that point of view they comprised the positive field for the shaping of a national conscience, projecting through the content of the studies and methods of teaching, the ultimate 'example' of ancient Greece.

4. Incorporation of Natural Sciences in the Studies

In this complex the teaching of natural sciences is included, which while formally are never absent from any program of studies, in reality are placed in the wider area of classical studies and filtered through a philosophical-theoretical outlook. M. K. Stefanides describes the situation realistically: "in middle education, the teaching of Natural Sciences is either totally omitted, or represented solely by Physics, as a mathematical subject and sometimes (especially in the private high-schools) by Natural

History, and mainly Botany, taught usually by language teachers” (Stefanides 1948, p. 16).

Thus the conceptual pivot is formed, on which is based the secondary importance of science in relation to the teaching of the language-philosophical subjects. Also, the more the need to find methods of approaching the classical ideal is stressed, the more these methods are aligned toward that standard and the less the effort that is placed on forming a scientific language with the definitive characteristics of the Scientific Revolution of the Modern Period. On the contrary, the community of natural scientists seeks its identity by adapting the natural sciences to the literary habits of the intellectual status quo.

For example, the inaugural speech in the University, by professor of Mineralogy and Zoology Heracles Mitsopoulos in 1845, represents a formal specimen of ‘literate’ language, on the one hand because the pre-eminent position of philosophy is seen through it, and on the other hand because his whole argument is structured within a literary frame, following the intellectual trend of the times (Mitsopoulos 1845).

Stefanides, though, mentions quite often that the professors of natural sciences, affected by the established ideological orientation vis-à-vis the cultivation and invigoration of national conscience, conceived of their teaching more as a national than a scientific duty. Thus it was not at all rare, apart from the constant references to the History of ancient science which proved the superiority of ancient Greek intellectual origin, for the subject of Geography to begin “suddenly with patriotic abominations”, while “one of the usual experiments in the subject of chemistry was the concoction of liquid Greek fire, as some kind of admonition to the future arms bearers of Greece” (Stefanides 1948, p. 8–9).

Thus, the constant references to the history of natural sciences and the emphasis on the historical elements of scientific language, function on the one hand as a bank of proof of a glorious intellectual origin and on the other hand accommodate the social inclusion of the natural scientists in the current ideological standards. This means not only that the teaching of natural sciences becomes more constructive and the comprehension of the relative issues easier, but the positioning of this teaching becomes possible within the traditional functions of the educational mechanism, the field where national conscience is embedded and reinforced. This way, though, in the subjects of natural sciences the faithfulness to the applied spirit often weakens because it is undermined by the strong adoption of intellectual positions having obvious influences from the dominant ideological and national objectives.

5. Conclusions

The case of Hristomanos is characteristic of how the community of natural scientists negotiates the matter of progress and modernization on one hand and the need to pay homage to ancient Greek intellectual works on the other

hand. Hristomanos presents arguments about the progress and modernization of the state and aims at the institutional upgrading and spreading of natural sciences, but in reality he wants to avoid a rupture with the traditional ideology, seeking networks of access to the field of natural sciences without questioning the priority of the traditional functions of education.

The History of Sciences and the highlighting of the scientific achievements of the ancestors form a privileged network of access to the area of the science of the Modern Period. Hristomanos' text is based on an inner differentiation of the concepts of antiquity and modern science, although in the end, the expression of this differentiation gives complementary roles to the projection of the irreplaceable values of the Greek nation and the achievements promised by the sciences. Hristomanos, as has already been mentioned, does not question the deep scientific advances of modern science. On the contrary, he himself, in his splendid studies in Austria and Germany, received influences from and was affected by the academic environment of Universities, which, in the period that we are studying, were in the top level of scientific output. However, the reasons that impel him to draw examples from ancient Greek science and to construct his arguments on these must be sought in a different area: his seeking a way to legitimize his standpoints and skillfully place them among the values of the era.

The exploitation, thus, of the elements of the History of Natural Sciences and the highlighting of the cognitive continuity with antiquity, in combination with the ambient ideological atmosphere, creates a particular 'scientific' climate, almost identical to the ideological fabric of the times (Maniati 2001, p. 40–46). More specifically, although the frame of the science of the Modern Period is not rejected, nevertheless, scientific language is founded basically on the basis of a Greek-minded science, as it is selectively formed through ancient Greek tradition and an initially informal program of the History of Natural Sciences. But this retrospect into the world of national individuality and national past and the tendency to restore the cognitive continuity between modern science and ancient tradition, even though it supports the inclusion of natural sciences in the familiar intellectual mores, renders the History of Sciences in the late 19th century rather an obstacle to the unimpeded evolution of scientific thought vis-à-vis the revolutionary changes in and re-evaluations of natural sciences in Europe. It often results in being simply an attempt to compensate for the absence of a modern indigenous scientific tradition, trapping the natural scientists in a system of contradictions. Thus, although they formally seem to keep in contact with the proceedings of science in the West Europe, in reality their introversion distances them from the explosive scientific revolutions there, rendering the indigenous scientific scene rather obscure.

Notes

¹About how the educational system was shaped and evolved on the basis of covering the needs of ideology and its correspondence to the general structures of the development of Modern Greek society, see the classic work of Tsoukalas (1992). Also, some interesting references to this matter can be found in Dimaras (1983, 1994), and Bouzakis (1996).

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