

THE SCIENCES IN THE GREEK SPEAKING REGIONS DURING THE 17th and 18th CENTURIES.

The Process of Appropriation and the Dynamics of Reception and Resistance

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Introduction

What has been known as the Scientific Revolution of the 16th, and especially the 17th century was an exclusively European phenomenon. While the social, ideological, conceptual, theological, economic and political repercussions of the new ideas developed during the Scientific Revolution have been systematically studied within the setting of the countries where that revolution originated, only few historical works have dealt with the issues related to the introduction of these ideas to the countries in the periphery of Europe (that is, the countries of the Iberian Peninsula, the Balkans, the Eastern European and the Scandinavian countries). How did the ideas of the Scientific Revolution migrate to these countries? What were the particularities of their expression in each country? What were the specific forms of resistance to these new ideas and to what extent did they display national characteristics? What were the legitimising procedures for the acceptance of the new ways dealing with nature? Did the discourse used by the scholars for writing and discussing scientific issues share the same features as the discourse developed by their colleagues in the countries of Western Europe? Any attempt to understand the assimilation of the ideas of the Scientific Revolution in these regions and to assess the characteristics of the resistance to such an assimilation—especially during the Enlightenment—cannot ignore to discuss at least some of these questions.

In this paper we shall discuss some of the issues related to the introduction of the new sciences to the greek speaking world during the 18th century. Necessarily, we will, also, have to refer to developments in the 17th and 19th centuries. Such a discussion calls for a contextual approach: it cannot be conducted independently of an overall historical assessment of what it means for ideas that originated in a particular cultural and historical setting to have been «transmitted» into a different cultural milieu with different intellectual traditions and different political and educational institutions. We argue that the use of the concept of the transmission of ideas, though it is quite useful, it proves to be ultimately inadequate in contextualizing the introduction of the new sciences in the greek speaking world. A historiography built around the concept of transmission as opposed to a historiography built around the concept of appropriation, is, in effect, comparable to a historiography of an internalist approach as opposed to a historiography of cultural history. Undoubtedly the concept of transmission of ideas is of some use to the historian of ideas. This, however, is apparent only when the transmission of ideas is used for certain specific cases within a wider procedure of appropriation of multiple cultural traditions by

the Greek speaking societies during a specified period of their history. In these occasions the intellectual and institutional framework for the reception of the new ideas is, to a large extent, conditioned by the cultural and religious traditions of the countries in the periphery together with the role and structure of their educational institutions.

The purpose of the present work is not to examine how successful the transmission of the ideas of the scientific revolution was; our main consideration is to study the production of a distinct scientific discourse through the assimilation of western scientific ideas, and the fusion with the intellectual traditions within the Greek speaking world during the eighteenth century. To trace the origins of the transmitted ideas without assessing the particularities of their appropriation tells only part of the story. What is important in our case is to comprehend the ways the new scientific ideas had been assimilated within a cultural milieu where a synthesis of the Christian Orthodox religion with ancient Greek thought was already a strong element of the intellectual identity of the Greek nation of the 17th and 18th centuries. To this we should add the parallel processes of the legitimation of the new scientific ideas and of the economic and political restructuring of the Greek speaking regions, during the eighteenth century, which contributed to the formation of a new coherent ideological and political stand connecting the past of the Greeks with the future prospects of a nation under occupation. Quite often, a historiography based on the concept of transmission degenerates into becoming an algorithm to keep tabs on what is and what is not transmitted. Alternatively, acceptance or rejection, reception or opposition are predominantly cultural processes. And these are particularly useful in understanding the status of the new scientific ideas which were not the sum total of units, but, on the contrary, they comprised a network of interconnected concepts. The practical outcome of a historiography based on appropriation is to be able to articulate the particularities of the discourse being developed and eventually adopted.

The history of ideas of the greek speaking regions in the Ottoman Empire from the fall of Constantinople in 1453 to the Greek Revolution of 1821 is invariably tied with the educational policies articulated by the Orthodox Church and the Ecumenical Patriarchate. Simply put, the sciences in the educational institutions—which were under the jurisdiction of the Church throughout this period— were introduced as part of a modern curriculum which also (re)introduced ancient greek thought as having been the precursor of all the glorious developments in Europe. The introduction of the sciences served both to "enlighten" the youth as well as to help create a national consciousness through the establishment of an intriguing continuity : from the ancients through Byzantium to the present which will bring a future when "glory" will be re- established again in Greece. Thus, from the early years of the 17th century, the introduction of the sciences was subservient to the political and, to a certain extent, ideological reorientations of the Church and of the newly emerging social groups.

In this paper we would like to argue the following points.

1. Most analyses of the Scientific Revolution and the establishment of the new sciences in the various countries in Europe take into consideration a host of questions related to the formation of state institutions. Issues, for example, concerning patronage, the establishment of academies and the usefulness of the new sciences for economic production are couched within the context of the formation of state institutions. The situation was radically different in the greek speaking regions

and the Balkans which were under Ottoman domination. Quite naturally, apart from the church, the Greeks did not have any centrally administered institutions. In the study of the introduction and reception of the sciences a series of complicated issues enter the picture, especially since the Ottoman administration had granted to the Greek Orthodox Church the responsibility for the education of the Christian population. The content, however, of what was taught was not solely determined by the church. It was, rather, the confluence of largely similar but at times conflicting aims of the religious hierarchy, of the social groups with significant economic activity and of the scholars themselves. And in order to comprehend what appeared to be a unified educational policy of the church, it becomes necessary to articulate the relatively autonomous agendas of each of these religious and social groups.

2. In introducing the new sciences, the greek scholars did not attempt to introduce natural philosophy per se, but, rather, they sought a new way of philosophising. This discourse lacked the constitutive features of the discourse of natural philosophy as it was being articulated and legitimised in Western Europe and it was primarily a philosophical discourse. Though they may have been writing about the recent scientific developments, the greek scholars of the Enlightenment thought of themselves first and foremost as philosophers. They did acknowledge the uniqueness of the developments in Western Europe concerning the new sciences. But at the same time, they did not perceive these developments as a break with the approach of the ancient greek philosophers. The new sciences were, on the whole, interpreted as an expected corroboration of the programmatic declarations of ancient greek philosophers. In introducing the new scientific ideas, they were reluctant in adopting the discourse used by the natural philosophers in the academic centres of Western Europe. It is only within such an interpretative framework that one can comprehend the absence of any discussion concerning the character of the rules of the new ways to study nature, the processes of legitimising the new viewpoint and the initiation of consensual activities to consolidate the new attitude about the ways of dealing with natural phenomena. Their writings reflected three traditions, at times in conflict with each other, at times complementing each other. These were the scholastic-Aristotelian tradition, the neo-Aristotelian tradition and the tradition of the European Enlightenment. The introduction and teaching of the sciences necessarily reflected a synthesis of traditions which, quite often, obeyed ideological and political aims rather than complying with the dominant problematique of the natural philosophers of Western Europe. Of course, the greek scholars were fully conscious of the deep influence exerted to political philosophy by natural philosophy and this was not a secondary factor in their intellectual wanderings. Finally, such an interpretative framework helps us to understand why almost every one of the scholars who had played a significant role in the introduction of the new scientific ideas in Greece, wrote a book in philosophy or logic before publishing a scientific book. Physical, astronomical and cosmological writings give us an additional probe into the understanding of the characteristics of this idiosyncratic discourse that greek scholars attempted to develop during their attempts to introduce the new scientific ideas.

3. The great majority of the books written by the greek scholars were for educational purposes. It is also the case that in most books we do not find the strict presentation of theories that we find in the books written for the same purposes in Europe. It is often claimed that the greek scholars' varying degree of competence in understanding the details of the new theories is partly responsible for such sloppy presentations. The quality of students and the lack of any social needs for developing the sciences and the technology it entails are considered as additional

reasons to account for the «watered down» version of the sciences that were introduced. We disagree because such an interpretation is more or less the direct result of the use of the methodological approach where the notions of transfer and transmission dominates. The notion of transfer implies a kind of filtering process: there is a selective procedure in the transferring since it depends on who transfers the ideas, when and for what purpose they are transmitted. The study of the introduction of the sciences is often reduced to accounts of what is held by the filter. Such a viewpoint undermines the specificity of the sciences in Greece, that is the subtle transformations of the scientific ideas during their process of appropriation. The appropriation of the new scientific ideas needs the formation of the necessary discourse which reflects the network of constraining localities. When we speak of appropriation we mean the ways devised to overcome cultural resistance and make the new ideas compatible with local intellectual traditions. Hence, understanding the character of the resistance to the new scientific ideas becomes of paramount importance. In the case of the greek speaking regions the issue of resistance cannot be discussed independent of the character of the break with ancient greek thought. Ideological and political contingencies of Christian societies under Ottoman rule during the Enlightenment together with the dominance of the greek scholars in the Balkans, obliged an emphasis not on the break with the ancient modes of thought, but rather, on establishing the continuity with ancient Greece. For the greek scholars the new developments in the sciences in Europe were becoming primarily an evidence of the triumph of the programmatic declarations of ancient greek thought with its emphasis on the supremacy of mathematics and rationality, rather than a break with the ancient mode of thinking and the legitimation of a new way of dealing with nature. The developments in the sciences were not viewed as an intricate process which among other things involved a break with Aristotle, but rather, as developments which came to verify the truth of the pronouncements of the ancients. Furthermore, there were differences resulting from the overall social function of the scholars in the centre and the periphery. In the centre, the main role of the scientists was to produce scientific knowledge whereas their role in the periphery—perhaps with the exception of the Scandinavian countries - was entirely different. It was to disseminate this knowledge through the educational structures. Thus the predominantly productive role of the scientists in the centre has to be contrasted with the predominantly educational role of the scientists in the periphery. Finally, we shall also have to take into consideration two other factors. The first has to do with the educational agenda of the scholars since the discussion and the dissemination of the sciences was being exclusively realised within the educational institutions and many a times in reference to issues pertaining to education. The second factor has to do with the scholars' claim for a share of social power.

The years after the fall of Constantinople.

The last century of the Byzantine Empire witnessed works in astronomy, mathematics, alchemy and, of course, philosophy by scholars who comprised the intellectual elite of a society fraught with religious disputes and political struggles. The exodus of these scholars and their migration, mainly to Italy and France, followed the fall of Constantinople in 1453. In most instances, these scholars found their new environments quite agreeable and they adopted a rather sympathetic stand towards Catholicism. Even though this was a few years after the cries in Constantinople that a Turk's turban would be preferable to a Catholic's tiara, we should keep in mind that during the last decade before the fall, the dominant political forces had agreed to a united church —with Rome having the upper hand. It was a move aimed at convincing the Catholics —nearly two

centuries after the catastrophic siege and occupation of Constantinople by the forces of the fourth crusade between 1204 and 1261—to rally for the rescue of Eastern Christianity. After the fall, those who stayed behind and initiated the re-establishment of the educational institutions, were, as a rule, carriers of an anti-western attitude.

Immediately after the fall of Constantinople, Mohammed II allowed the Patriarchate to continue its function. The Patriarch was recognised by the Sultan as the legal chief of the orthodox nation. Most importantly, the Patriarchate was given the privilege to have full jurisdiction over the education of the orthodox Christian populations in the Ottoman Empire and, eventually, the right to develop the appropriate mechanisms to collect some form of taxation from the parishes, while at the same time it was set free of tax obligations towards the Ottoman state. The Sultan's decision was, partly at least, meeting the contingencies of the new era of the Ottoman Empire. The serious difficulties relating to the administration of a continuously expanding Empire with a progressively increasing Christian population and the threat by Christian Europe could be eased by granting this limited political autonomy to the Patriarchate as well as by taking advantage of the deep animosity between the orthodox church and Rome. The Orthodox Church was at the time the only organised institution by the agency of which the various Christian nations of the Balkan peninsula could be represented collectively in their dealings with the Ottoman administration. Furthermore, the Patriarchate had already created a well structured mechanism of ecclesiastical hierarchy which allowed the control even of the smallest Christian community in the area. Moreover, the choice of the Patriarchate as the de facto political representative of the Christian populations of the Balkans, would contribute to the consolidation of the newly acquired lands in the West. During that period, the idea of a European crusade against the Ottoman Empire under the aegis of the Catholic Church was a strong element of political coherence of threatened Europe. The appointment of the Patriarchate as an autonomous political institution as well as the strengthening of the forces that were contrary to the union of the Churches were intended to minimise the possibilities for the realisation of such plans. The Sultan, Mohammed the Conqueror, appointed as the new Patriarch Gennadios Scholarios (1400-1460) who even though was among those who had agreed with the union earlier, had turned into a fierce anti-unionist in the last years before the fall. It should be noted that since 1450 the Patriarchate was in effect headless, though nominally the Patriarch Gregory the third was in Rome. Gennadios Scholarios was a well-known legalist, rhetor and philosopher, and played an important role in the political life during the last years of the Byzantine era. As a philosopher, he was of aristotelian orientation, follower of Aquinas and an opponent of Pletho's platonism. Among his writings we note Synopsis of Aristotle's Physics with Simplicio's commentaries and Against Pletho's Queries of Aristotle. He was an officer of the Byzantine state, and a member of the committees that represented the Orthodox Church during the negotiations with the Catholics. Though at first an advocate of the union of the Churches, he soon became a fierce opponent of the union attacking the attempts of the emperor Constantinos Paleologos to come to terms with the Pope Nicholas V. Historians agree that the Emperor's motives in agreeing with the union of the churches was dictated less on religious grounds and more on the hope of guaranteeing the military support of the western countries for the confrontation of the Ottomans. Especially during the siege of Constantinople, Gennadios Scholarios expressed an intense propaganda against the Catholic Church. When Mohammed conquered Constantinople he saw in Gennadios the suitable person for becoming a Patriarch. Gennadios, as the first Patriarch, undertook the task of reviving the intellectual life of the city. He founded the first official school, the Patriarchal Academy, which

was the continuation of the Pandidakterion of the Byzantine era.

Gennadios appointed Mathaios Kamariotis as the first director of the academy. The exact date of his birth is unknown, but he died in 1489 or 1490. He remained director of the Patriarchal Academy up to his death. There is no information concerning the curriculum of the Academy. However, we could suppose that it was similar to the standard Byzantine curriculum, since Kamariotis had been a well-known teacher for many years before the fall. From the part of his work that is known to us today we can see that he had included in the curriculum ancient Greek literature, rhetoric and theology, while he was an opponent of Pletho's ideas.

By the end of the 16th century and within the context of counter-reformation after the Council of Trent (1545-1563), Rome defined a new policy towards the Greek population of the Ottoman Empire. The main of this policy was to prevent any reproachment between the Protestants and the Orthodox. In the beginning of the seventeenth century the Patriarchates, of Constantinople and Jerusalem, became fields of contention between the Catholics and the Protestants. The Jesuits attempted to create Catholic zones in the eastern Mediterranean basin and to this purpose they co-operated with the Ottomans, attempting at the same time to bribe several officers of the Orthodox Church.

The College of Saint Athanassios (Collegio Greco), in Rome, where most of the eminent Greek scholars attended classes, played an important role in the development of the political influence of the Catholics. This College was founded in 1577 and its main mission was to provide higher education to the Greeks of the Ottoman Empire through the study and acquaintance of the world of the Catholic Church. Scholasticism and theology according to the teachings of Aristotle and Thomas Aquinas constituted the basic part of the curriculum. Thus, initiation to the doctrines of the Catholic Church, ancient Greek and Latin literature, Aristotelian philosophy and advanced theological education were included in the curriculum of the school. Graduates returned to their country with the obligation to propagandise Catholicism, to cultivate the Greek letters, and to support anti-Ottoman ideas, since the Ottomans were still considered to be the main enemy of the Christian world.

During the same period, the Protestants were trying to increase their influence in the eastern Mediterranean region, especially through the activity of the ambassadors of England, Holland, Germany, and Sweden. Not unexpectedly, they offered support to the Patriarchates of Constantinople and Jerusalem. A common enemy, the Catholics, brought the Protestants and the and the Greek Orthodox close to each other. At 1620 Kyrillos Loukaris (1572- 1638) became Patriarch of Constantinople. During the early stages of the 30- year war, Loukaris planned a series of political moves to consolidate the survival of the Orthodox Church. He felt that there were unmistakable signs of an impending alliance between Catholic France and the Ottomans. He saw such an alliance as the main danger against the Orthodox Church, and he sought supporters among the Protestants. He turned to the Dutch and the ambassador of Holland to the Ottoman Court turned out to be a very co-operative ally. He, also, proceeded to write an infamous leaflet arguing for the common theological grounds between Calvinism and Orthodoxy. Many and serious theologians —and not only his adversaries— accused him of adopting Protestantism.

Being convinced that the Catholic propaganda was effective because of its educational institutions, Loukaris upgraded the Patriarchal Academy and introduced what came to be known as religious humanism. He himself had studied at the Greek school of Venice, under Maximos Margunios, from 1584 until 1588 and he had completed his studies at the University of Padua in 1593. Religious humanism was an attempt to synthesise the teachings of ancient Greeks with the teachings of the orthodox church fathers, considering the intellectual traditions originating in greek antiquity and those of Christianity as a unity. Religious humanism became the means for moulding a kind of national consciousness by reclaiming the hellenistic roots through greek orthodox Christian teaching. In the prevailing conditions of intense national reorientations and regroupings in Europe, such a strategy aimed at upgrading the political role of the Patriarchate by providing an institutional expression to the ties between orthodoxy and hellenism. Such initiatives did not only lead to the establishment of new educational institutions, but, eventually, they led to the furthering of the church's dominance through the articulation of a new ideological and political agenda. The conception that the Orthodox Church must safeguard the great intellectual tradition of the nation and protect Hellenism from the "Turk despot and the propaganda or the contrivances of Catholicism" was given a theoretical justification and an institutional expression.

The strong and systematic reference to the ancients eventually created a space for lay theology and this will be proven decisive for the way the greek scholars will collectively decide to promote the new scientific ideas. Establishing new schools ([see map](#)) with new curricula had a very specific purpose: to keep alive and modernise a national culture whose constitutive domains were the ancients and orthodoxy. And the new scientific ideas were, at least partly, introduced as a means of underlining the continuity and success of the ancients' agenda.

In 1622 Kyrillos Loukaris appointed a renowned neo-Aristotelian, Theophilos Korydalleas (1570-1646), to the directorship of the Patriarchal Academy. He had studied in Italy during the first decade of the seventeenth century. In 1604 he attended classes at the Greek College of Saint Athanassios, in Rome. He also studied at the University of Padua where he became doctor of Philosophy and Medicine, around 1608. He was at the University of Padua when Cremonini was the dominant figure and the articulate defender of Aristotelianism, especially against the new science of his colleague there, Galileo Galilei. In the Patriarchal Academy Korydalleas reorganised teaching along the ways practised in Padua. A central place was assigned to philosophy —as distinct from theology— and to the interpretation of the commentaries on the main Aristotelian works. Korydalleas' humanistic brand of philosophy contained the sperms of a rupture with a strictly theological approach to nature and to human affairs. But at the same time, there was a conscious policy to contain and develop this new approach exclusively within the framework of neo-Aristotelianism, during a period when such a framework was being undermined and redefined elsewhere in Europe.

Theophylos Korydalleas, even though was well acquainted with Descartes' philosophical and scientific works and he had, undoubtedly, come into contact with the ideas and the debates about heliocentrism during his stay in Italy, promoted the Aristotelian worldview. Nowhere in his works did he mention the heliocentric system, not even in order to criticise it. In 1626 he is purported to have written his Global Geography according Ptolemeus. This work was never published but references to it from his students provide strong indications that it was a piece

which revived the interest of Greek scholars in the work of the Alexandrian astronomer, fifteen centuries after its first presentation. Korydalleas, however, held a different viewpoint than Ptolemy. While the latter sought a mathematical description and modelling of the celestial movements, Korydalleas focused on the physical, qualitative description pointing out the Aristotelian dimension of the Ptolemaic system. The Earth was at the centre of the universe because, according to Aristotle, heavy bodies tended to fall towards the centre. The celestial spheres moved around the earth, depicting the various orders of divinity. He also insisted on the main Aristotelian separation between the eternal and perfect world beyond the Moon and the world of decay beneath it. At the end of the text Korydalleas discussed briefly the earthly and celestial circles, providing a descriptive account of the Ptolemaic theory of epicycles.

Korydalleas, through his teachings, contributed decisively to the gradual fusion between the Orthodox Christian theology and aristotelianism. The new methods of mathematical physics and the quantitatively oriented study of nature are nowhere to be found among his works. Against the unified, homogeneous, deterministic, and infinite universe of the newly articulated cosmology, he juxtaposed the finite and closed aristotelian world, as well as a geocentrism inspired by theology. His writings continued to exert a strong influence for a long time even though some of the future scholars were not too willing to endorse all of his views, especially since he had also been accused of Calvinism and atheism. Nevertheless, Korydalleas was the first teacher after the fall of Constantinople who provided a frame of reference to be available to Greek educators for the coming years and despite the criticism directed against him he continued to teach under the aegis of the Church.

Introducing the new scientific ideas

Most of the second half of the 17th century and a large part of the 18th century was a period of educational and economic rejuvenation of many sectors of greek society. In this period the Fanariots who were basically the Greeks who lived in Constantinople, would play a dominant role. The beginning of this period is characterised by the completion of the Ottoman expansion and the creation of some of the prerequisites for the economic development of new Hellenism. From the end of the 17th century, the Fanariots acquired an increasingly important role in the administration of the Ottoman state. At the outset of the 18th century representatives of the Fanariots were appointed by the Sublime Porte governors and hospodars in Wallachia and Moldavia. The Fanariots will soon take the lead among all the other Greeks dispersed in the Balkans and their political dominance will underline the already strong influence of the Greeks in the economic as well as cultural spheres in these regions, while at the same time as administrators and as diplomats they will display what is commonly referred to as the consciousness of enlightened despots. This period is characterised by three interdependent developments. The first is the rising influence of this group of Greeks who became actively involved in the administrative affairs of the Ottoman Empire. Their increasing influence undermined the almost exclusive role the clergy had in mediating the relations of the Christians with the Court. The second characteristic of this period is the increasing receptivity for the new ideas coming from Europe by the Fanariots whose relative autonomy from the Patriarchate was further strengthened by an agenda of «europeanization». The third characteristic is related to the rise of a new social group. In addition to the Fanariots, the merchants, started to assert themselves socially and played a rather significant role in the intellectual orientations of the

period. The symbiotic relationship between the merchants and the quasi-administrative group of Fanariots was not always without antagonisms. Often, for example, they were at odds concerning the exertion of influence on the Patriarchate. The social and economic prominence of these groups slowly led to the weakening of the absolute control the Church had on the founding of the schools and in determining their curricula. The Fanariots, for example, took many initiatives for the establishment of new schools ([see map](#)). At the same time, greek scholars started moving all over Europe. Italy ceased to be the almost exclusive place for their studies. Greek scholars started travelling to the Germanic countries, Holland, and, Paris. They were, thus, intellectually influenced by a multitude of traditions and schools—and that was true for their training in the natural sciences as well. Interestingly, it was during that period that we witness a strong tendency of the scholars to return home after the completion of their studies abroad. There were, basically, two reasons favouring the return of the scholars. The first was the growing needs for scholars and teachers in the schools which were being founded as a result of the economically thriving greek communities dispersed in various regions within the Ottoman Empire and outside of it. Especially after the mid-1700s there was a upsurge in the establishment of new learning centres of "higher education". These were to be found in the greek communities established in great mercantile centres like Venice or Vienna, or in Wallachia and Moldavia, or in cities containing sizeable greek administrative communities like Bucharest and Iasi or in the Ionian Islands or in cities with large greek communities like Ioannina or cities on the coast of Asia Minor. Individuals or groups of people, very often expatriates, gave money or bought books and equipment for these schools. In some schools, like in Chios and Milies, these endowments resulted in remarkable book collections. These schools, both as centres of intellectual activity as well as expressions for educational and patriotic philanthropy became paradigmatic of greek Enlightenment. The second reason for the return of the scholars had to do with their gradual marginalization among their colleagues in Europe. Almost all of the scholars who went to Europe were churchmen having the blessings of the Patriarchate. They were among the best who had mastered the amalgamation of ancient thought together with the teachings of the church. In their travels to Europe, however, they found a different Europe than what they were led to expect from the narratives and experiences of the scholars of the preceding generation. During the early part of the eighteenth century they found a Europe dominated by the ideas of the Scientific Revolution, with flourishing scientific communities involved in the production of original scientific work. The institutions where the greek scholars could indulge in the all-embracing studies of philosophy and continue the kind of education they had already acquired, were progressively decreasing. The scholars were faced with a paralyzing dilemma: to become part of the community of the natural philosophers in the places where they were studying, the greek scholars had to abandon religious humanism. Being ideologically unwilling and intellectually unable to proceed to such a break, they immersed themselves in the study of the new sciences with a view to return home and assimilate them in the curriculum of religious humanism. A characteristic example of the application of this conception was the increasing desire to teach the new sciences in a manner that harmonised with the conceptions of the ancients. No wonder that almost all the books on the new theories written by greek scholars in the eighteenth century reflected, and very often explicitly expressed, their "debt" to their ancient predecessors. This conception of an uninterrupted continuity and the perfection of ancient knowledge—a conception that was essentially adopted and promoted by the church—constituted one of the basic characteristics of the greek scientific culture during the Enlightenment. During that period the main pursuit of the Greek scholars remained the delineation of the constitutive aspects of a

philosophical discourse, within the context of which the new ideas of the scientific revolution would be fused with the aristotelian tradition and the Orthodox Christian ontology. In 1716, almost a century after the start of the directorship of Theophylos Korydalleas in the Patriarchal Academy, Chrysanthos Notaras (1663-1731) published his work *An introduction into Spheres and Geography*. At the time, Chrysanthos was Patriarch of Jerusalem succeeding his uncle Dositheos. Both had been particularly active in consolidating the economic and political presence of the Orthodox Greeks in the Holy Lands and in opposing the claims of the Catholic Church. Chrysanthos had started his studies at the Patriarchal Academy and, later on, in 1696, he was sent to Vienna and later to Venice and to Padua. In 1700 he visited Paris where he made astronomical observations at the Paris Observatory for several months. Though he never practised teaching, in 1707 he proposed a reform programme for the Academy of Bucharest, which later was also used for the reforms instituted at the Academy of Iasi (1714). Ancient Greek literature, philosophy and the natural sciences were the main courses of that programme. However, Chrysanthos proposed the teaching of philosophy according to Korydalleas' model of neo-aristotelian philosophy, though he himself had already studied at European universities almost a century later. Chrysanthos' astronomy followed Korydalleas' footprints. By this time, however, aristotelian cosmology was a commonplace in all greek schools. But Chrysanthos' aim was to advocate the geocentric system as opposed to the current theories of heliocentrism. Though he exhibited some tolerance towards Copernicus and discussed his ideas, Chrysanthos, as a staunch follower of religious humanism, was always pointing out that Copernicus' ideas were nothing more than a reproduction of the cosmological model proposed by Aristarchos of Samos. In the first part of his book he shortly described the main schema of aristotelian cosmology, while in the third he developed in detail the arguments in favour of geocentrism and against the rival heliocentric system. His conclusive argument had to do with the absence of any internal or external cause that could account for the «circular or straightforward movement of the Earth». He, thus, thought that he had proved that the Earth remained still in the centre of the universe. Notaras' conclusion was more of philosophico- theological than of scientific nature: since the Ptolemaic system could describe the celestial phenomena at least as adequately as the Copernican system could, the adoption of the former was further necessitated by its agreement with the Scriptures and the senses. This situation changed radically after about the middle of the 18th century when a great number of the Greek scholars became supporters of the heliocentric system. That heliocentrism found quite a few adherents was not independent of the fact that the polemics against heliocentrism were not particularly intense. Those who were against the heliocentric system presented all the cosmological systems to their pupils, and came out in favour of the geocentric system, based either on the Scriptures and/or Aristotle or, as Evgenios Voulgaris did, on recent observations which could not find stellar parallaxes. We should also note that the Copernican system had a peculiar affinity to the Greek Orthodox thought: many authors presented the heliocentric system to have had an origin in the Pythagorean ideas. Hence, heliocentrism could be considered as part of a national spiritual heritage —reminding in a way that the Church continued to be the guarantor of the traditions of the Greek nation. For that reason it was not strange to see many times both systems to be accepted as valuable hypotheses: though geocentrism was to be preferred, heliocentrism —to the extent that it had its origins in the ancient Greek thought— did not necessarily undermine the ontological contentions of religious humanism. One of the adherents of heliocentrism was Iosipos Misoidax (1725- 1800) who appears to be fully conscious of the fact that the traditional model of the cosmos by Aristotle had not been simply subjected to some minor changes, but that it had been substituted by a new and

dramatically different system. In his works he presented the claims of Copernicus and he also discussed the invention and role of the telescope, the discovery of the solar spots as well as Newton's gravitational theory. Iosipos Misoidax was born in Cernavoda, Bulgaria. He studied at the School of Mount Athos between 1754 and 1755 when Evgenios Voulgaris directed the school. Towards the end of the same decade he visited Venice, Padua, Hungary, and Vienna. In 1761 he translated and published Muratori's Moral Philosophy, in Venice. In 1765, he started his career as a teacher in the hegemonies of Danube. A committed educational reformer, his ideas were considered to be in opposition to the theology of his days and he was obliged to defend himself from the attacks of his opponents. For this purpose he published in 1780 his work *Apologia*, in Venice. Though his most forceful contributions were in the field of political and social philosophy, his works contained extensive references to the recent attainments of the sciences. The following year, he published the *Theory of Geography*, where among other topics he presented the various theories concerning the motion of the Earth. Though it was obvious that he was a strong defender of heliocentrism, he tried to safeguard himself: while he was in general agreement with the beliefs of most of the natural philosophers in the West, he continuously scrutinised their arguments and held their logical structure as a gauge to ascertain their accordance to the terms of good reasoning. In the same text and in trying to moderate the strong reactions which would be caused by the presentation of heliocentrism, he wrote that heliocentrism was put forth so as «to innovate means to imitate the Pythagoreans», thus attempting to dress the new theories with the respectable cloth of antiquity.

Misoidax appeared to be fully aware of the implications of the new theories. The place of man within the cosmos had been altered, and as a result, the order of values had changed as well. At the same time, he was knowledgeable of the course which the newer sciences charted in order to modify the traditional world-view. Though Copernicus was the «glorified rejuvenator of real Astronomy», the breakdown of the aristotelian universe was caused by the use of telescopes, the discovery of the solar spots, and the study of comets, which showed that the universe was uniform and homogeneous, and that there was no physical distinction between the world above and below the Moon. The culmination of his ideas was considered to be the combination of new mathematical thought with the experimental tradition within the framework of the Newtonian synthesis.

Misoidax ascribed to mathematics an educational merit which he had not ascribed to logic and metaphysics. In fact, he had accused Aristotle for undermining the interest in the study of Mathematics and expressed his admiration of Galileo, Descartes, and Newton because, in his opinion, they restored the respect for Mathematics; he thus considered the teaching of Mathematics together with experimental Physics to be of great value for a modern educational curriculum. In his work *Theory of Geography* he presented the arguments for the heliocentric system together with the claims of the adherents of geocentrism. Although he pretended that he was keeping equal distance from both views, his way of organising and presenting the arguments clearly indicated his preferences. He started his analysis with a programmatic distinction between science and the Holy Scripture, and he was led to the rejection of all theological arguments concerning the structure of the universe. He, then, reconsidered the issue of the absolute reliability of the senses, which comprised a strong cognitive bulwark of aristotelian thought; at the same time, he rejected the premise that phenomena which take place below the Moon are distinguished from the ones which occur above it, and he expressed his agreement with

the idea that nature is homogeneous. His arguments for the Earth's motion were completed with an appeal to Kepler and Newton, whose laws, as Misoiodax stressed, confirmed and validated the heliocentric hypothesis. Iosipos Misoiodax adopted the ideas of the new sciences without having to devise detailed arguments against aristotelianism. He considered the break with the aristotelian cosmology to be the end of a whole era and established his proposals for educational reform upon the undisputed acceptance of the new image of the cosmos as was put forth by contemporary science.

Another eminent scholar of the time was Evgenios Voulgaris (1716- 1806), one of the more intriguing personalities of Greek Enlightenment. He was born in Corfu and died at the age of ninety at the court of Catherine the Great. He studied in Corfu under Vikentios Damodos, an important scholar of the period. He continued his studies in the School of Ioannina (a wealthy commercial town of western Greece) under Athanassios Psalidas. After he became a priest, in 1737 or 1738, he went to Italy in order to study theology, philosophy, european languages and natural sciences. In 1742, he became director of an important school of Ioannina. There he was involved in a public dispute with Balanos Vassilopoulos, who was the director of another high level school of the district regarding the curricula of their respective schools –Voulgaris arguing for the institution of natural philosophy. From 1753 to 1759 Voulgaris was appointed director of the School of Mount Athos aiming at upgrading the level of studies. There he taught philosophy as well as mathematics. Though he was considered to be one of the most eminent teachers, his strong adherence to the new ideas caused the reaction of the religious hierarchy of Athos, and he was forced to abandon the school in the beginning of 1759. He, then, moved to the Patriarchal Academy and in 1761 he permanently abandoned his educational career. The presence of Voulgaris in the various schools of the Greek speaking world gave rise to antagonisms because of his adherence to the new scientific ideas and his cocky personality.

Voulgaris wrote and translated many books on a wide variety of subjects, mainly to use them for his teaching. Most of these books remained unpublished or were published many years after the end of his educational career, while he was living in Russia. Like most scholars of his time he initiated his intellectual activity with the publication of a book on Logic (Leipzig, 1766). He continued with the publication of Elements of Metaphysics (Venice, 1805), What Philosophers Prefer (Vienna, 1805) —an amalgam of the recent ideas of the sciences and Philosophy— and About Universe (Vienna, 1805) where he discussed the contemporary astronomical theories. It would be interesting to note that he also translated —though not published— works of Locke, Wolff, Du Hamel, and Pourchot. Although Voulgaris who was an ordained priest, was one of the most systematic initiators of the new scientific ideas into the Greek speaking world, he remained throughout his life an adherent of the idea that the gnosiological authority of the Scriptures was much more valid than any other cognitive approach to the world. In this sense, Voulgaris typified the case of a Greek scholar who assimilated the attainments of the Enlightenment by incorporating them in a discourse within the restricted framework of religious humanism. Actually, Voulgaris did not seem to appreciate the meaning of the experiential re-orientation which, among other things, characterised the new sciences and the emergence of a new ontological context. He was trying to combine the new theories with the teaching of the ancients, which he strongly believed to be the foundation for any modern knowledge. He refused to acknowledge the crucial position experimentation and mathematics had in the new scientific discourse developed among the natural philosophers in Europe. In Voulgaris' view physics

should derive its corollaries mainly through reasoning. It is true that in his translation of Segner's *Elements of mathematics* he underlined the necessity of algebraic knowledge for the study of the world and for the proper understanding of physics. Nevertheless, while his perception of the proposed connection of mathematics with physical inquiry was restricted to a mentalist context, in his subsequent work he tended to connect the use of mathematics with philosophy, following the exemplar of the ancient Greeks. As will be discussed later, the case of Veniamin Lesvios — another eminent scholar of the Greek Enlightenment— was similar to that of Voulgaris: Lesvios suggested that the application of geometry in astronomy rendered the latter the quality of science; but although he acknowledged the contribution of analytic geometry in the formation of the modern scientific discourse, he considered it to be difficult as well as lacking in elegance and he promoted Euclidean geometry as the appropriate tool for the education of young people.

Voulgaris' work *About the Universe* was written for teaching purposes and contained his main astronomical views. Though it was published in 1805, it is presumed to have been completed before 1761, the year he abandoned his educational activities. When the book was published the 89-year old Voulgaris was a recluse at a monastery hardly communicating with anyone and, thus, it was not at all clear whether he was even asked to acquiesce for the publication of the book. This book was mainly an amalgam of the work of various European philosophers. Voulgaris did not hesitate to recognise that the Ptolemaic system was obviously contrary both to observations and common sense. That, however, did not mean that he was favouring the truth of heliocentrism. He mentioned a number of arguments expressing the lack of any experience concerning the revolution of the earth. His main argument, however, was of gnosiological nature and had to do with the validity of the Scriptures: though their main target is the salvation of human soul, they also accommodate some natural truths which are able to support moral teachings and reveal Divine Providence; and though the movement of or the stillness of the Earth is irrelevant for the salvation of the soul, we are obliged to accept the divine assurance of the Earth's stillness as the most reliable. The Ptolemaic system was inadequate and heliocentrism involved cognitive hurdles that prevented Voulgaris in accepting it; he thus preferred a third interpretation which he considered to be the most reliable, namely the system proposed by Tycho Brache. Voulgaris was the only scholar in the Greek speaking world, who embraced the Tychonean system in the middle of the eighteenth century. His argumentation, however, was not simplistic; he was fully acquainted with the subject under consideration. His main objective was to confirm that the Tychonean system was in accordance with the astronomical observations, and that it interpreted a host of phenomena that Ptolemy's system could not explain sufficiently and that it was, at least, as valid as the heliocentric system. Furthermore, by placing the still Earth in the middle of the universe, this system was of higher value since it was not inconsistent to the Scriptures. In 1794, the Fanariot Panagiotis Kodrikas translated Fontenelle's *Entretiens sur la pluralité des Mondes*. This quasi-popular book discussed the idea of an infinite universe and the plurality of worlds. The translation included many notes by Kodrikas. One would have expected that a translation of a book written nearly a hundred year earlier would not be a high priority. Yet, Kodrikas chose to translate an old book so that he could include his "explanatory" notes which were nothing less than a parallel text to the one he translated. In 1794, however, he did not hesitate to write against "those who due to superstitious ignorance do not acknowledge the established truths of the Copernican system." The translation of *Entretiens sur la pluralité des Mondes* provoked a strong attack against the followers of heliocentrism, and it finally was condemned by the Church not because of the ideas of Fontenelle, but because of the translator's

comments which were in conflict with the traditional values of religious humanism. With Kodrikas' translation we have, for the first time, such an explicit reference to the role of the founders of modern physics (with the exception of Galileo who does not seem to be so dear to the Greek scholars of the time). It is noted that Copernicus had, in fact, put the Sun to the centre, but he had not changed the structure of the cosmos. It is, furthermore, noted that Descartes had broken away from the Aristotelian world-view and, finally, the significance of Newton's synthesis is brought to surface.

The French Revolution did not appear to sit well with the Fanariots' political agenda. Many of them considered the Revolution and its consequences as developments endangering their prospects of gaining progressively greater influence within the Ottoman Empire. As the French Revolution was more and more projected as the realisation of the political and social ideas of the Enlightenment, the Fanariots' belief in and attachment to the ideas of the Enlightenment started to wane. Furthermore, as the anticlericalist positions of the Revolution were being identified with the spirit of the Enlightenment, many scholars - who, as we stressed, were men of the Church - were becoming less and less willing to air their support of the Enlightenment ideas. Naturally, we are not talking of a radical change which was adopted by all concerned. However, we do stress a change of heart among many scholars in their strong backing of the ideas of the Enlightenment and which, as a result, gave a greater leverage to those in the Church who were strong opponents of these ideas from the very beginning. Of course, quite a few scholars, especially teachers, continued to remain strong adherents of the new scientific ideas. This rather mixed situation and change in the mood of the scholars was quite evident in the attempted changes of the school curricula. That influence is displayed in a very typical way at the Megali tou Genous Sholi (a continuation of the Patriarchal Academy). During 1778-1801, the director of the school was Sergios Makreos, who remained faithful to the traditional educational system of the school. He reacted against the proposed reforms and he did not even want to include in the curriculum the books of Voulgaris who was Makreos' teacher and for whom he felt great respect. Makreos was born around 1740 and he died in 1819. His studies were exclusively within the Greek speaking areas of the Ottoman Empire. He attended classes at the School of Agrafa (a mountainous region of central Greece) and then he went to the School of Athos under Voulgaris. He completed his studies under Voulgaris at the Patriarchal Academy in Constantinople. During his directorship he was teaching Aristotle according to Korydalleas' system, and though he was proud of being Voulgaris' student he refused to bring in the curriculum the new sciences and philosophy, because he believed that they would lead to the abolition of the traditional social values. In 1797 he published *A Trophy from the Greek panoply* against the followers of Copernicus. Makreos was not interested in presenting a strict scientific rebuttal of the argumentation that was supporting the heliocentric system. Besides, it seems that he was not acquainted with the course of the relevant events and conceptual changes which led to the final form of the heliocentric theory as expressed in the Newtonian synthesis. By attacking the Copernican ideas he attacked all the new astronomical theories —among them the infiniteness of the universe and the inhabitation of the stars. Makreos' arguments against heliocentrism were not predominantly "scientific", but he chose to stress the social repercussions of each model: the overthrow of the traditional hierarchical and static world expressed by geocentrism, would bring about the downfall of social hierarchy. Makreos through a number of syllogisms attempted to discredit Newton's theory of gravitation. He considered that the motion of every body was determined by the outcome of two forces, the centripetal and the centrifugal. He discussed two

cases. The first was when both forces are applied onto the same body and more specifically on the Earth . According to the Aristotelian viewpoint the centripetal force is considered natural whereas the centrifugal violent. But again according to Aristotle it is impossible for a body to execute natural and violent motion at the same time. Hence there is a contradiction. In the second case one of the forces is applied to the Earth and the on the Sun. Independent of the kind of force applied to each body, the net result of this situation would be for the Earth to be attracted and repelled by the Sun at the same time. According to Makreos this has the following consequences. Either the Earth will move in a straight line and there will be no reason for it to revolve or, if the two forces are equal in strength, then the earth would be motionless for ever. All these syllogisms led Makreos to conclude that the law of universal attraction cannot justify the heliocentric system. It is important to underline the qualitative character of the arguments as well as the ignoring the law of inertia. Of course, Makreos' had a rather shrewd strategy: he used the most «quantitative» of Newton's laws and showed that it is self-contradictory and that it cannot lead to what Makreos considered as unquestionably qualitative characteristics of the cosmos. The way he developed his arguments revealed his intention to put them under a pre-determined cosmological schema. At the same time, he presented an analysis of the gnosiological preconditions for heliocentrism, which, in effect, comprised the main part of his book. He adopted the main points of the Aristotelian world-view and rejected the image of an infinite, homogeneous world that the new astronomy implied. He tried to restore the validity of the senses and proposed simplicity as the criterion for the correctness of the astronomical theories. Furthermore, he questioned the validity of astronomical observations together with the reliability of "mathematical instruments". He claimed that we cannot decide about what is happening in the sky from what we observe from beneath the Moon, because these comprised two different realms with two different classes of phenomena. One of the main objectives of Makreos was defending the aristotelian world-view within the context determined by the Orthodox Christian faith. He was concerned that by accepting the eternity and self-motion of matter, Aristotle could be interpreted in such a way as to render the act of Creation unnecessary. For this reason, part of his work was attempting to explain that matter is created and it is passive. Creating it and putting it into movement demanded the mediation of the highest power and of the eternal energy of God. By placing cosmology within this context Makreos was stressing, at the same time, the cognitive limits of man. There is no way for knowledge to surpass the limit imposed by the relationship between humans and their Creator. Therefore, knowledge should always be subjected to the truth of the Holy Texts. Hence, almost two hundred years after Galileo and his telescope, Makraios remained an aristotelian by totally rejecting the possibility of even a limited updating of traditional cosmology.

Since the middle of the 18th century the economic well being and the accompanying social changes of the greek communities within the Ottoman Empire brought about a number of changes in the educational system. The reception and appropriation of the new scientific ideas was taking place within an environment of social unrest and ideological confrontations. One cannot talk about educational reform, since the attempts had to do with local initiatives rather than a centrally dictated policy to be applied to a homogeneous educational system. While in the seventeenth and at the beginning of the eighteenth centuries schools were religiously oriented, the coming years saw the emergence of schools whose curriculum could cater for the social and

political agendas of the merchants or the Greeks who were involved in the administrative mechanism of the Ottoman state. The systematic introduction of the sciences was being reinforced by the renewed faith in man's ability to acquire knowledge of the world with his own means and all these found a convenient ally in the expectations of the assertive merchants and in the political ambitions of the Greek officers of the hegemonies of Danube. Within this context, there was a gradual re-determination of the teachers' role. The image of the teacher-priest whose work comprised a kind of religious mission gave way to a kind of scholar who in their great majority were priests, whose educational agenda became more secular and the actual work of the teacher tended to be more «professional». The scholastic and grandiloquent teaching of the works of the Fathers of the Orthodox Church, of ancient Greek literature and of Aristotle, gave way to a curriculum which was determined through negotiations with the community which had established and catered for the schools. Teaching started serving the social, political and ideological «priorities» of these communities. These changes contributed to the strengthening of the relative autonomy of the scholars from the Patriarchate and reinforced their role as independent scholars. At the end of the eighteenth century, instituting the new ideas of the Enlightenment at the schools became the subject of social negotiation. For many Greek scholars the European nation states represented an exemplar, while at the same time they offered the necessary ideological background for the constitution of a new political discourse to be articulated by the adherents of the Enlightenment. The various methods for the introduction of knowledge were changing because as the scholastic were progressively realising, the knowledge to be introduced was of a new kind. Teaching had to become pleasant and attractive in order to cultivate curiosity and ingenuity. Visual means supplemented the readings: maps, globes, experimental instruments, experimental demonstrations themselves became the pride of teachers. Constantinos Koumas (1777-1831) was claiming that he was the first teacher who conducted physical and chemical experiments at the Philological Gymnasium of Smyrna, in 1812. Philosophy became part of the educational process as a source of social ethics, and good reasoning. Thus, observation, experience, the cultivation of good reasoning, and the fight against superstition became the main educational objectives necessary for uprooting ignorance and bringing progress according to the promises of the new sciences. Cultivating the sciences was aiming at the integration of the Greek speaking world into the group of European nations, its other objective being the strengthening of the secular pole of power to counterbalance the Church. At the same time, the natural sciences appeared to be the answer to the social demand for craftsmen-scientists, and for the merchants' dealings with their counterparts in Europe. The publication of commercial handbooks and the establishment of innovative schools was also expressing that trend, declaring the clear objective, at least of some merchant groups, for undermining and denouncing the traditional educational system. During the whole of the eighteenth century and until the Greek Revolution of 1821, there was no branch of the natural sciences —with the exclusion of medicine— organised into a distinctive cognitive field with institutional autonomy. The scholars who were dealing with the newest scientific ideas were being differentiated on the basis their general ideological and political affinities; only medical doctors tended to become a separate profession. The work of the rest of the Greek scholars had social aims within the context of the interests of various social groups and this is the reason why the scientific discourse was integrated into a more general political agenda. The ideas that had originated during the scientific revolution appeared more as an educational activity covering certain social demands or contemplative quests, and less as a method for practical research. They became knowledge to be acquired and not a method for producing new knowledge. In the Greek

speaking world, we cannot trace a trend whereby scientific practice is transformed into a socially structured activity having as its main element the experiential research of the world. Nevertheless, towards the end of the eighteenth century the number of published scientific books was increasing. Greek scholars started writing and translating a large number of scientific works to be published in cities like Venice, and Vienna. A common practice was the dedication of the works to eminent persons of the Greek speaking world. Dedication was part of the politics of patronage. On the part of the writer this politics aimed at legitimising his work and his ideas expressed through it. The most important element of this practice, however, was the promotion of specific social values, that is the cultivation of literature and arts, of virtue and piety, as well as the promotion of political visions for the benefit of the nation. A point to be stressed is that the scholars seemed equally interested in legitimising the content of their work as well as a more general social programme within which their work should find its place. The readership for the scientific works became progressively more diversified. In the middle of the eighteenth century, scholars like Nikiforos Theotokis, and Evgenios Voulgaris were writing for specific cultivated audiences. Their books published in the decade of 1760 were addressing their readers as «friends of sciences». Towards the end of the eighteenth century, however, the authors started addressing their readers in a more general way, without rendering specific qualities to them. At the same time, the phrases «to the Greeks» or «Philhellenes» appeared as well. The word «Greek» together with a reference to «nation» was still having the meaning of «learner of (ancient) Greek» or «educated person» as it was the case in the middle of the century; a widening of the meaning, however, was now taking place, rendering to the word cultural connotations related to the collective consciousness of the Greek speaking orthodox Christians of the Balkans. This widening brought about changes in the idea of science, its role, and its cultivation. «To the reader» was a rather common address in the prefaces of scientific books of the time suggesting that the expectation for the «uprising of the nation» could be also helped through scientific education. Such an address was also implying the idea of education as a key element in the concept of citizen. As a criterion to gauge the development of science they considered its spread to as many people as possible: Though not everybody was capable of practising science —since that was a matter of specialisation— everyone did have the potential to acquire scientific knowledge for the enlightenment and felicity of the nation. When at the beginning of the nineteenth century the question was raised as to who would have the authority to decide about the soundness of the different scientific conclusions, Greek scholars gave an answer characteristic of the way they had perceived the ideas of the scientific revolution: Though in the west the newer scientific discourse was already formulated as a network of regulatory principles handled by a structured scientific community, the Greek scholars considered the general public to be a legitimate judge of scientific knowledge. The «principles of science» were considered to be sufficient knowledge for anyone in order to take part on an equal basis in a discussion with the natural philosophers in the west, since exploration of natural issues demanded nothing more than good reasoning and common sense. The ambivalent attitude towards the Enlightenment after the French Revolution was noticed in the various schools of the Greek speaking areas of the Ottoman Empire. One example was the school at Kydonies in Asia Minor. The man who played an important role there was Veniamin Lesvios (1762- 1824), who studied Mathematics and Physics at Pisa and Paris during 1789-99. At Paris, Lesvios met Korais —the «theoretician» par excellence of the Greek Enlightenment — and was deeply influenced by his views. Lesvios proceeded to a number of reforms and during his directorship (1802/3-1812), the school acquired a fame for the best school for science. There, Lesvios taught the new Physics and —something

quite unique— the heliocentric system per se; he also taught Philosophy and Mathematics. However, during his stay in the School of Kydonies, Lesvios was accused for introducing dangerous innovations through his scientific teaching, and rejecting divine incarnation. He was, thus, forced to give testimonies for his religious orthodoxy to the Patriarchate, though he was not asked to deny his scientific beliefs. Living, however, in a period during which the Ecumenical Patriarchate had officially expressed its opposition against the new ideas of natural philosophy — because of their ideological and political implications— he did not succeed in persuading for the orthodoxy of his beliefs, and he was condemned by the Holy Synod. In 1819, he left Kydonies and went to the Peloponnesse, to take part in the uprisings of the Greek Revolution. Before proceeding with the examination of Lesvios' physical philosophy, we should note the emergence of a distinct anti-European trend in the early years of the 19th century. Athanasios Parios was the most characteristic representative of this trend. Parios had spend some years at Mount Athos and he, then, became a teacher of Greek. He taught at the school of Chios, an island near the coast of Asia Minor, the same period that Veniamin Lesvios was teaching at the school of Kydonies. Because of his extreme conservatism, many scholars of that period attacked him and students started gradually to abandon the school and moving to the school of Kydonies. Parios had some general knowledge of physics which he had acquired from the classical treatises and the commentaries on Aristotle's physics. He was the writer of a polemical book called *Response* published in Trieste in 1802. The full title of this work speaks for itself «Response to the frenetic zeal of the philosophers who come from Europe; exposing the vanity and folly of their lamentable efforts exerted upon our Race and teaching which is the real and true philosophy. To which is added a salutary admonition to those who recklessly send their sons to Europe on business». The Christian, declared Parios, should not examine the secrets of the creation of the material world, because in this way we are able to reach only at some hypotheses and not at proven conclusions. For that reason the mathematical sciences are the source of godlessness Let us now discuss the work of Lesvios and especially his "all-mover". This «theory» is a paradigmatic case in support of our main contention. It is a work whose structure and argumentation is incommensurate with the dominant scientific problematique of the period and it is at the same time a characteristic example of an attempt to form an alternative scientific discourse. It was never published but was systematically taught and Lesvios' manuscript where he developed the theory and discussed physics and astronomy dates from a few years before 1800. Lesvios had serious objections about the validity of Newton's first law. He could not accept that bodies, left to themselves, will continue to preserve their kinetic identity. He maintained that the motion of bodies left to themselves will die down. In other words he disagreed with what had been accepted as the constitutive aspect of the new physics: That force is necessary to change the direction of motion. Lesvios would have liked to have force initiating motion. Furthermore, he proceeded to explain the revolution of the planets through the assertion of an effluvium which is emitted from and absorbed into the bodies in proportion to their mass. From the schema it followed that the body with the largest mass (the sun) should be at the centre. The equilibrium of the forces as a result of the absorbed and emitted effluvia guarantees the stability of the positions of the planets with respect to the sun, the rotation of the sun around its axis guarantees the revolution of the planets around the sun and the difference in intensity between the effluvium of the sun and that of the planets when these «meet» and create a kind of vortex near the planet gives the latter a turn around its axis. Newton's first law was not merely a synthesis of the various issues related to inertia. Equally important, it formed part the context of consensus about the ways the new physics will be practised. The first law dictates the study of

the changes in the direction of motion and forbids the search for the causes of motion. And even if we accept that at the beginning of the 18th century natural philosophers did not all agree on what was the range and the character of the legitimate questions to be asked within the framework of the new physics, by the time Lesvios was having these ideas, there was no doubt about the kind of questions natural philosophers were allowed to ask. Lesvios' problematique, and his methodology made up a program for understanding the metaphysical foundations of physics and, in this respect, Lesvios' agenda was much closer to the programs of Leibniz and Kant. His theory may have been the result of his difficulties in accepting action-at-a-distance and the generally favourable climate in Europe concerning the heuristic value of the imponderable fluids. And even if we grant that Lesvios' belief in these fluids may not have been undermined by the developments in chemistry and the recent explanation of oxidation, the way he developed his theoretical schema was qualitative, it was aimed at explaining what was already known and observed and nowhere did he indicate the possibility of either a new phenomenon to be associated with his schema or a quantitative prediction which could be measured. Lesvios had been educated in Europe and in his writings we witness a rather systematic knowledge of what the state of science was. How are we to understand what he was attempting to do? How can we understand the rejection of Newton's laws and his theory of gravitation and at the same time the adoption of the heliocentric system? What should we make of his projection of demonstrations rather than experiments? And how are these to be contextualised when we know that he was one of the ablest teachers and not a charlatan proposing theories of everything? Lesvios attempted to articulate a form of discourse with the following characteristics. Based on the metatheoretical characteristics of the dominant schemata in physics (as was the case with the imponderable fluids and/or heliocentrism) and on the criticism of Newton's theory of gravitation (action at a distance) he proceeded to the formulation of a philosophical system where the foundational principles would lead to the explanation of as many phenomena as possible. Thus it is not strange that he rejects Newton and adopts heliocentrism. It is, also, not strange that he and especially his student Kairis, extend his theory to include feelings as well—in fact, such a theory must be able to be extended in such a direction. Lesvios developed his theory of within a framework of what he considered as physics and astronomy and not as part of his metaphysics. In other words, Lesvios' physics is neither something popular which caters mainly to educational needs nor is it a piece whose purpose is to inform about the developments in the west. Lesvios' agenda, if viewed as an attempt to propose an alternative theory within the framework of the scientific discourse as formed in the west, has no legitimation whatsoever. But if this is seen as an attempt to propose an alternative discourse to the (western) scientific discourse—a philosophical rather than scientific discourse—then his whole program does not appear to be so idiosyncratic. Lesvios' work is a typical case of appropriation of the new scientific ideas into the cultural milieu of the Greek speaking world. His work cannot be interpreted if the dominant methodological tool and historical category we use is that of transmission. It is, no doubt, the case that many ideas had been introduced in the Greek speaking world by ways which could be perfectly well understood through the use of the theoretical tool of transmission. These are the easy and straightforward cases. However, the effectiveness of a methodological tool is gauged by the possibilities it provides for the understanding of what appears to be exceptional -- in this case, what appears to be a whimsical, superficial and «not so scientific» theory by a well educated scholar. Thus, during this period a number of issues were reformulated in order to be appropriated within a context determined by a number of philosophical needs, ideological outlooks and political imperatives. The appropriation of the new scientific ideas needs the formation of the necessary

discourse which –as we stated in the introduction-- reflects the network of constraining localities. During the time that Veniamin Lesvios was teaching at Kydonies another eminent scholar was the director of one of the most famous schools in the Greek speaking world. It was Constantinos Koumas, director of the Philological Gymnasium of Smyrna in the western coast of Asia Minor. Since he was the director, he was responsible for the teaching of scientific courses. The Philological Gymnasium of Smyrna was one of the most important educational centres of the Greek speaking world in the last period of the Ottoman Empire; thus, it would be interesting to examine the way the concepts concerning the role of sciences in the social context of the time were depicted in the curriculum of the school. Constantinos Koumas was born in 1777 and was one of the Greek scholars who practised teaching as a profession and not as a part of their religious mission. He was very interested in Mathematics since his early years. After a short period of teaching, he went to Vienna, in 1804, where he completed his studies and published various scientific works. In 1809 he was invited to Smyrna to take over the Philological Gymnasium; he remained there up to 1814, and, then, he went to Constantinople to take over the directorship of the Patriarchal Academy. Koumas had received a doctorate in Philosophy and Fine Arts at the University of Leipzig and was a member of the Royal Academies of Berlin and Munich. Under his directorship, the school in Smyrna became famous, especially due to his methods of teaching the physical sciences: the «mysterious instruments» used in classes attracted a great number of wealthy Greeks, who sent their children for studies at the Philological Gymnasium of Smyrna. As a result, the Evangelic School, another important school in Smyrna with theological orientation, gradually declined. Nevertheless, a current of opposition concerning the introduction of scientific ideas and the secular orientation of the curriculum in the Philological Gymnasium was gathering momentum. The scholars who advocated the conservative policy of the Patriarchate reacted to the liberal policy of the merchants, who, in turn, advocated the introduction of the innovative ideas in the intellectual life of the Greek speaking world. As a result, in 1819, during a major political disturbance in Smyrna, a violent crowd burnt the Philological Gymnasium. The teaching of the sciences became the main axis of the curriculum at the Philological Gymnasium of Smyrna. A key argument for the introduction of scientific courses was the necessity for scientific knowledge to return to its birthplace. Koumas in his translation of Pierre August Adet's Chemistry, in 1808, defined chemistry so broadly, and made such an idiosyncratic interpretation of Aristotle's texts, that allowed him to conclude that ancient Greeks were the real initiators of current chemistry. It was a conclusion deriving from the belief that it was impossible for ancient Greeks, who had developed every other science and art, not to have developed chemistry as well. In 1812, Koumas published A Synopsis of Physics where he also developed his educational programme: «According to the ancients, Philosophy was divided into three parts, Logic, Ethics, Physics. Every kind of science and art is reduced to these three genders of Philosophy. Whoever intends to lead a good life in society should not ignore any of these parts». When he defined Physics, however, he was more interested in the development of a visual teaching method than in the prescription of a method for scientific research. Physics was defined as the science «that teaches us about the phenomena, as well as the reasons or forces which cause them». Though experimentation and observation were considered as the key methods of research the whole concept was closer to an Aristotelian qualitative interpretation of the phenomena than to the quantitative study of nature and the derivation of mathematically formulated conclusions. It should be pointed out that the school in Smyrna acquired its fame —among other things— because of the physical and chemical experiments that were being conducted there by Koumas, who also supplied the school with

maps and globes. Those experiments, however, were not related to any kind of original scientific research; they were rather repetitions of the demonstrations of phenomena, which had already been studied by the natural philosophers in the west. Thus, though Koumas stressed the usefulness of experimental research, the separation of experimentation from mathematics, and from the quantitative evaluation of its results, dissociated it from the specific heuristic value that it acquired within the context of the scientific discourse developed in Europe. The time that Koumas published *A Synopsis of Physics*, Constantinos Vardalachos, another important scholar, published his *Experimental Physics*. This work consisted of a collection of his analytic notes for the courses he had been teaching in the sciences at the Academy of Bucharest. Vardalachos makes a distinction between mathematical physics, «which is proven by geometry and calculation» and experimental physics «which is proven by the phenomena [i.e. observations]», justifying, in a way, the elimination of mathematics from his teachings. In the beginning of the nineteenth century, even though the introduction of physics in the curricula of the modern Greek schools was considered one of the main intellectual innovations, the almost exclusive use of qualitative interpretations restricted it within an aristotelian context. The notion of experimentation and observation was not related to the way experiments were being conducted by the scientific community in the west during the same period. For Greek scholars, experiments were demonstrations which intended to motivate students during teaching and convince them about the validity of the qualitative interpretations concerning the origins of various phenomena. The use of experimentation for the discovery of new phenomena and/or for the quantitative survey of the natural world, as it was the case with the western natural philosophy, was out of their scope.

Final comments

Let us summarise some of the salient aspects of these developments:

1. It appears that a standard approach where the emphasis would be on understanding the formation and function of social institutions such as patronage and the academies is ineffective in the case of the greek speaking world during the 17th and, especially, the 18th century: We want to understand the ways the new scientific ideas were introduced and established in a region which was part of the Ottoman Empire. The jurisdiction of the Church over educational matters, its initiatives for sending scholars to Europe to be educated and the kind of dynamics created as the intended and, most interestingly, unintended result of their scholarly work — be it by writing books or teaching— should be assessed within the overall particularities of the greek case. A number of complicated issues will also have to be taken into consideration. The ambivalence of the Church towards the shifting philosophical allegiances and the ideological orientations of the scholars; the relations of the Church with the Ottoman administration; the relations between the ecumenical Patriarchate of Constantinople and the other (autonomous) Patriarchates each facing different problems of their own (e.g. the Moscow Patriarchate and the attempts for modernisation by the new ruling classes of the 18th century); the relations of the Orthodox Church with the Holy See and the Protestant world; the often conflicting interests of the prominent and rich lay figures at Constantinople with those at other places in the Balkans.
2. It was accepted by all that the Patriarchate had the absolute responsibility in formulating the long term educational policies and articulating the ideological agenda for a synthesis between

hellenism and orthodoxy. This did not mean that the ensuing developments went smoothly as instantiations of the original programmatic directions. There appeared many different trends each claiming for itself either the ideological or the political leadership of this process aimed at preserving religious identity and inspiring national consciousness. These trends were at times in conflict with each other and at times complementing each other. Scholars following the scholastic aristotelian tradition, co-existed with neo-aristotelians. Scholars adopting the ideas of the Enlightenment came into conflict with those who viewed these ideas as undermining the agenda of religious and ideological survival. The introduction of the sciences and their subsequent teaching necessarily reflected a confluence of all these trends. The glorious developments in western Europe concerning the new sciences became an interesting but expected corroboration of the programmatic declarations of Aristotle. Social groups who found confidence in the ideas coming from Europe for their political future, turned against the ideas of Enlightenment after the French Revolution. Processes related to national consciousness of the Hellenic population acquired a relative autonomy from issues related to theological questions and religious humanism could no longer contain the antagonisms. And the Patriarchate reflected and conditioned these changes. Progressively it became less receptive to ideas and policies that it itself had welcomed about two centuries earlier --but there again, it had mostly achieved what it had set out to do.

3. One of the difficulties in trying to analyse the newly emerging community of scholars in the greek speaking regions has to do with the relative lack of consensus among the scholars as to the constitutive discourse of the community. The study of the emergence of the scientific community in the various countries of Western Europe deals with the ways a group of people managed to reach a consensus as to the discourse they were to use in discussing, disputing, agreeing and communicating their results in the new field. In the greek speaking world from the first decades of the eighteenth century until well into the nineteenth century, the discourse that the scholars developed was substantially different from that of their colleagues in Western Europe. The (expected) social role of the scholars and their ideological prerogatives legitimated a discourse which was predominantly philosophical. Furthermore, there appear to be additional reasons for the becoming of such a discourse. Firstly, there were neither internal nor external factors to precipitate a crisis with aristotelianism and, therefore, no need to reformulate let alone initiate a break with aristotelianism as a result of such a crisis. Secondly, the dominant mode the scholars wished to establish was a kind of logic with had strong ethical implications related to the rules of correct argumentation. Thirdly, although these scholars appeared quite sympathetic to experiments, what they considered to be experiments was hardly different from demonstrations. The emphasis, usually indirect but often explicit, was about the use of the new material for (re)shaping philosophical arguments. Most importantly, there was a lack of emphasis concerning the crucial relation between theory and experiment. It is quite remarkable that in almost all the books where there is mention of experiments the emphasis is on observation and (qualitative) results, rather than on the process of measurement and dealing with numbers. In more than one place one finds passages to the effect that "rational thought is not less effective than experimental results".

The introduction of the new scientific ideas in the greek speaking world was a process almost exclusively related to their appropriation for educational purposes. The apparent aim was to modernise the school curricula, but this did not mean a neutral attitude as to the possible

ideological uses of these new ideas —especially the need to make contact with the heritage of ancient Greece. There were attempts to form a discourse which would be convenient for supporting the overall political agenda. The problem under consideration here was the introduction of the new scientific ideas to a national community which was under occupation and which did not have their own national state institutions. This is a very unusual situation where the lack of national state institutions did not provide any of the conditions where the effectiveness of the educational system and of the training of students in these sciences could be socially gauged. Lacking such a corroborative framework where the utilitarian character of these sciences would be under continuous vigilance, ideological and, in fact, philosophical considerations became the dominant preoccupation of the scholars. Hence, the embedding of all these new ideas within a philosophical context which was so strongly at variance with that of the European scholars became an aim in itself since it was the only way these new ideas could be legitimised.

Bibliography

Argyropoulou Roxane D. "Traductions en Grec moderne d' ouvrages philosophiques (1760-1821)" *Revue des etudes sud-est Europeennes* , X, 1972, 363-372.

Cavarnos C., *Modern Greek Thought*, Belmont, Mass., 1969. The emphasis is on the philosophical ideas of the 17th and 18th centuries.

Demos Raphael, "The Neo-Hellenic Enlightenment (1750-1821) A general Survey", *Journal of the History of Ideas* 19, 1958, 523-541.

Dimaras C. Th. *La Grece au temps des Lumieres* , Geneve Librairie Droz, 1969.

Henderson G.P. "Greek Philosophy from 1600 to 1850", *The Philosophical Quarterly* , 5, 1955, 157-165.

Henderson G.P., *The Revival of Greek Thought 1620-1830*, State University of New York Press Albany, 1970

Herig, Gunnar *Okumenisches Patriarchat und europaische Politik 1620- 1638*, Franz Steiner Verlag, Wiesbaden, 1968.

Kitromilides, P.M., «The idea of science in the modern Greek Enlightenment» in P.Nicolakopoulos, editor, *Greek Studies in the Philosophy and History of Science*, Kluwer Academic publishers, Dordrecht, 1990, pp.187-200.

Pallis A.A. *The Phanariots. A Greek Aristocracy under Turkish Rule*, London 1951.

Papaderos Al., *Metakenosis. Das kulturelle Zentralproblem des neuen Griechenlands bei Korais und Oikonomos*, Mainz 1962.

Tsourkas Cl. *Les debuts de l'enseignement philosophique et la libre pensee dans les Balkans. La*

vie et l'oeuvre de Theophile Corydalee (1570- 1646) 2nd ed. Thessaloniki, 1967.

Voumvinopoulos G.E., Bibliographie Critique de la Philosophie Grecque depuis la chute de Constantinople a nos jours 1453-1953, Athens, 1966.