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Debates and diatribes in Milanese religious orders at the time of Boscovich

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Abstract. Many religious orders were involved in education at the time of Boscovich, but I thought that it would be useful to focus on the Barnabites and the Jesuits, which were extremely active in Milan in that period. Debates and diatribes among these two religious orders are discussed.

1. Introduction

A detailed research into the entire matter, with its wide ramifications, would require too much time and probably would not bring to light particularly interesting results for the history of scientific knowledge in the era of the Enlightenment in Milan. At that time, in fact, there were many religious orders involved in education (see Storia di Milano 1957, 1959). However, they were mostly concerned with providing their pupils with a basis of prevalently humanistic knowledge. In that period it was very difficult to find schools, run by religious orders, that were open also to contemporary scientific education in keeping with the times.

From this point of view, I thought that it would be useful to define the field of research and focus attention on two particular religious orders, the Barnabites and the Jesuits, both extremely active in Milan in the second half of the XVIII century (Cariani & Brenna 1987; Polla 1989) represented, furthermore, by two illustrious men, the Barnabite Paolo Frisi (Melegnano 1728-Milan 1784; for an initial bibliography see Baldini 1998 and Gentili 1987) and the Jesuit Ruggiero Boscovich (Dubrovnik 1711 Milan 1787; essential bibliography in Casini 1971; Altieri-Basile 1983; Paoli 1988) who knew, admired and emulated each other, also through criticism of their reciprocal viewpoints. To be truthful, hints of criticism, sometimes subtle and concealed, came above all from Frisi towards Boscovich. In any case, in spite of all the difficulties and conflict, the scholar from Ragusa appeared of the two to stand taller as a man of science.

The two scientists had different childhood backgrounds as well as different characters. Boscovich was soon able to enjoy the benefits of an international school which brought him quite young from Ragusa to place him in the unlimitedly open cultural life of the Collegio Romano, where he completed his broad education in the humanities as well as in scientific subjects. The years he dedicated to matters concerning logic, mathematics, geometry, astronomy, geodesy and mechanics at the Collegio Romano, and the corresponding publications which derived from these interests of his, showed his extraordinary capacity to assimilate those Newtonian-Leibnizian theories which were to provide him with the material to write his probably most significant work, *Philosophiae naturalis theoria* (1758).

Frisi, on the other hand, was educated mostly in Milan, at the Scuole Arcimbolde, run by the S. Alexander Barnabites, and afterwards at Pavia, where he was able to attend lectures held by the famous mathematician Ramiro Rampinelli, an Olivetano monk, who had also taught Maria Gaetana Agnesi (Rampinelli 1760; *Lezioni di ottica*, published posthumously one year after his death, are also attributed to him). His most important readings date back to Pavia: Newtonians *Principia* with the comments of the Minimi Fathers Thomas Le Seur and Francois Jacquier, the writings of Leonhard Euler, and of the English Newtonians and the French Enlightenment by Jean Baptiste Le Rond d'Alembert.

Boscovich showed a constant spiritual attitude in all matters during his life - in some ways somewhat difficult - revealing to those who came close to him that he was above all a convinced Jesuit, enlisted in that mission of evangelisation which transcends and is incarnate in many different ways in the ministry entrusted to its members within the order founded by Ignatius Loyola. On the other hand, similar conviction was not be noted in Frisi's belonging to his ideal as a Barnabite (Gentili 1987) [1]. In fact sometimes we have the impression that he had difficulty in reconciling his religious vocation with that of a man of letters and science: sometimes he would have preferred to carry out his role as a scientist, in a completely independent manner with respect to his belonging to the Barnabite order.

Boscovich, bearing the burden of his immense scientific knowledge, proved on several occasions that he was endowed with a particularly ductile spirit, as an expert conversationalist and fascinating entertainer such as he was, whereas Paolo Frisi showed at various times the hardness of his character and the scarce flexibility of his soul, which however allowed him to face adversity and injustice with firmness and spirit of endurance. Maybe he would have benefited, on the one hand, from deeper knowledge of the evil and malice that are hidden in the hearts of men and, on the other hand, from more command of himself in expressing, with excessive confidence, judgments on other scientists.

I should like to stress here that for some years the two men shared the city of Milan as the place for their scientific interests and teachings. In fact, Frisi, after some brief episodes of teaching at Lodi and Casale Monferrato, was awarded the Chair of Philosophy at the Scuole Arcimbolde in Milan (1753-1756) and after a brief spell of teaching philosophy and mathematics at Pisa (1756-1763), was awarded in 1763 the Chair for Mathematics at the Scuole Palatine in Milan: a professorship which he kept until he died (1784). Thus for more than twenty years he taught in the public section of the Scuole Palatine in Milan. During this long period of teaching in that city he shared the territory with Father Giuseppe Boscovich who, after a long period of teaching at the Collegio Romano and various diplomatic and cultural missions in the world (from Austria to France to England and then back to Austria) was called, in 1764, to Pavia University as a professor of mathematics and astronomy. He kept this professorship until 1768, when he was asked to teach specialised mathematics at the Scuole Palatine in Milan, with some discomfort for Frisi who, under that governmental ruling, saw almost a personal *diminutio* and succeeded, in 1770, in obtaining in the same school a Chair for mechanics, hydrometry and theoretical architecture. In the meantime, as of 1764, while he was still teaching at Pavia, Boscovich had become involved in the building of a new astronomical observatory in Brera, but his commitment to this project lead to many misunderstandings, envy and hostility

[1] We could in fact speak of a kind of clash within him of the two vocations, that for study and that for religion. Verri himself was in doubt as to the real motivations of his religious vocation "All'età di quindici anni egli entrò nella Congregazione de' Chierici Regolari di S. Paolo, ossia de' Barnabiti, o fosse questa risoluzione presa per un fervore religioso, o che a tal partito lo portasse la condizione domestica, o vi fosse indotto da' maestri, i quali distinguevano la esimia penetrazione della di lui mente, e antivedevano l'onore che doveva fare al loro ceto un giovine, che dava somma speranza; egli in quella Congregazione fece i suoi voti" (Verri 1787)

from his own colleagues and fellow Brothers [2], so that in 1773 Boscovich retired from the honorary post he occupied at the Observatory and, simultaneously, from teaching at the Scuole Palatine.

In fact Frisi, already in his work *De existentia et perfectionibus Dei* (Frisi 1754), which was a collection of his philosophy lectures at the Arcimbolde - in particular philosophical theses discussed with him by two pupils of his, Count Carlo Premoli and Ottavio Pusterla - had taken on a tacitly contentious attitude towards Boscovich. In those years he was certainly approaching a natural deistic theology, by affirming the existence of God starting from rational arguments (Frisi 1754, p. 15), but against the rationalism of Spinoza and Leibniz, he denied any possibility of reducing thought to matter [3]. The strong point and prospectic angle of his argument, as we shall soon see, is the *inertia* or rather the *otiositas* of the matter, without denying the value, in general, of other possible arguments of a metaphysical, physical, philological-humanistic and mathematical.

At the same time, he did not agree with Boscovich either, who appeared to place the essence of matter in its impenetrability, which was produced by repelling forces. Instead Frisi, in this document, intends to affirm absolute inertia as the essential quality of bodies. They do not in fact possess either a reason to exist or a reason to move, precisely because all that which is material has no reason to be. As a consequence, he denies that matter is conceivable as an atomic collection of centres of force, a collection of points which attract and repel each other infinitely. It is this very strong opposition to the Leibnizian conception of nature that distances Frisi from Boscovich, already on the subject of natural philosophy. To tell the truth, in the document *Dello stato delle Scienze*[4], he affirms that already in the dissertations printed in Lucca in 1761 he had proved the inconsistency of the theory of the "impossibility of contact and of indivisible elements of bodies".This theory derives directly from Frisis doctrine "Motus (...), attraction, gravitas, & quae aliae vires in corporibus hujus universi omnibus (...) deprehenduntur, sunt proprietates accidentales corporum adiectae extrinsecus (...): ipsa autem corpora essentialiter inertia, otiosae, & principio quocunque agendi destituita esse debent" (Frisi 1761 p. 215). In that century, in which the planes of philosophical and scientific research are entwined and easily confused, Frisi, adhering staunchly to the Newton of *Principia*[5], maintains in physical ontology a theory that opposes that of Boscovich, who, in the meantime, bearing in mind also the theory simply overshadowed by Newton in *Opticks* (with regard to forces that attract and repel alternately)[6], had already approached Leibniz's *Monadologia* [7] in his

[2] For the whole discussion see (Schiaparelli 1938) in particular pp. 13-17, where opposition to Boscovich by the Jesuit P. Luigi Lagrange (1727-1783) is dealt with in detail. Lagrange was considered *de facto* Direttore della Specola. With regard to the energetic genius of Boscovich, compared to the meticulous diligence of Lagrange, and with regard to the entire matter, Schiaparelli rightly observes: "[Lagrange] non era fatto per dirigere grandi intraprese. Egli fuggiva altresì dai contrasti e dalle molestie che sogliono opporsi a chi si accinge a creare cose nuove. Lagrange non sarebbe forse giunto ad ottenere in venti anni ciò che Boscovich con infinite sollecitudini e pagando, dove occorreva, del proprio, condusse a termine nei soli anni 1764 e 1765" .

[3] This theory is sustained also in Frisi (1761) pp 197-221; in particular "Erit enim impossibile ut corpora velint, cogitent, intelligant", p. 220

[4] I used the autograph manuscript conserved in Ambrosiana, listed as Y 163, ff 1-17, which bears the complete title *Dello stato delle Scienze presso i Gesuiti in due secoli dopo la loro istituzione* (1778).

[5] The structural (portante) function of the principle of inertia according to Newton, starting from the *Definitio III* ("Materiae vis insita est potentia resistendi)", which presents matter as a pure passive force, as explained by Le Seur

[6] and Jacquier, "Inest omni materiae vis insita passivae, sive inertia" (Newton 1739-1742, vol. I, p. 4). This regards *Query XXXI* placed at the conclusion of *Opticks* : "Have not the small Particles of Bodies certain Powers, Virtues, or Forces, by which they act at a distance, not only upon one another for producing a great Part of the Phaenomena of Mature?" (Newton 1730)

[7] The Leibnizian definition of "monad" as "simple substance" should be borne in mind, as a constituent element of things with the following explanation: "Or là, ou il n'y a point de parties, il n'y a ni

Philosophiae naturalis theoria , and had tried to offer his philosophical-scientific vision capable of integrating in synthesis the thought of two great scientists (cfr. Boscovich 1763, §§1-5; this edition is now more easily accessible under Boscovich 1922, pp. 34-35).

According to Frisi, on the other hand, the real essential characteristic of bodies is *inertia*: *"Corpora ex sui natura prorsus inerti & otiosa sunt"*[8], thus to say "body" and to say "inert matter " is the same thing. Not even God could create a body that was not inert, because this would be contradictory, thus the following proposition is valid: "Non potest Deus rerum essentias immutare", a proposition which is followed by another: "Neque ergo poterit Deus producere corpus, quod non sit iners, quodque ex se aliquod principium actionis habeat"[9]. In this way Frisi thought he had rigorously defined the difference between "matter" (corporeality) and "spirit", which in his opinion was not at all guaranteed by Boscovich with his theory, which reproduces fundamentally leibnizian assumption: the contents or ultimate constituents of matter are "metaphysical points", that is to say "immaterial", "unextended", "indivisible" Boscovich (1763). However, the widest reconstruction of the tacitly controversial relationship between the two scientists is today possible from their correspondence, collected by Gustavo Costa (1967). These letters cover at least a decade (1760-1770) of correspondence between the two scholars, which is extremely interesting for us and enable us to clarify the controversy that arose between them, with particular attention to their stay in Milan and in the surrounding area. The reader may note that, for the most part, the letters are written in extremely ceremonious and praising tones, as was the custom in the 17^{th} century.

On the one hand Frisi informs Boscovich about his fortunate situation in Pisa and tells him at the same time about his "anxious" feelings at the moment when he is about to be transferred to Milan to the Scuole Palatine (1763); on the other hand, Boscovich confides in Frisi about the need for and scarsity of books, which situation arises on the occasion of his transfer from Rome to Pavia (1764), in fact he confesses that he almost regrets having accepted the chair in Pavia, as he is then forced to leave Rome, which he considers his second home (Costa 1967).

From what is possible to read in their correspondence, bristling with mathematical formulae and geometrical figures, their reciprocal relationship was based on the deepest wish to cooperate with each other. Nevertheless, conflict was latent and maybe also not very well concealed. In fact, Frisi, in his dissertation *Sull'atmosfera dei corpi celesti*, which was awarded a prize by the Paris Science Academy in 1758 and published in Italy in 1579 (Frisi 1759) had strongly attacked *De lunae atmosphere*, published by Boscovich in Rome in 1753 (Boscovich 1753). In particular on pp. 130, 133-134, Frisi accuses Boscovich of reducing the moon's ring too much:"Annulum coarctare voluit Boscovichius: non sine aliqua, ut mihi quidam videtur, observationum omnium injuria". However, this disagreement hung over their relationship, certainly spoiling it, especially on Frisis part, but never being explicitly acknowledged by Boscovich, until Lalande, as we shall see, put him in the picture.

Conversely, the differences between the two men with regard to the controversial figure of the count Francesco Algarotti (1712-1764) was very much in the open. While Frisi was inclined to believe in a pious death, Boscovich was much more reluctant to express judgment. He only judged critically Algarotti's fundamentally naturalistic perspective, especially in philosophy. In fact in him he saw a representative of that natural religion that does not trouble itself to attribute value to the specific contents of Christian revelation (Costa 1967).

Another point of contrast between the two men is represented by the different attitude towards the *Encyclopédie*, in particular as far as the figure of Jean-Baptiste Le Rond, known as d'Alembert, (1717-1783) is concerned. Frisi's

étendue, ni figure, ni divisibilité possible" (Leibnitz 1840-1974, p. 705) .

[8] Frisi (1754),Propositio III, p.28

[9] Frisi (1754), Propositio XXIII,p. 47 and 48, (Costa 1967) fasc. III, pp. 819-876

constantly severe and harsh judgment regarding the progress of the Jesuits in scientific knowledge speaks for itself. Apart from the repeated critical remarks which in this regard are mentioned in the *Elogio del Cavalieri*, we must consider what he affirmed in the above-mentioned manuscript *Dello stato delle scienze*[10]. Going back to d'Alembert: he is the author of the famous document, anonymous and with misleading printing notes, entitled *Sur la destruction des Jésuites* (D'Alembert 1775).

Boscovich, for his part, was never a friend at any cost of the Illuminists, in particular he could not have had any sympathy for this great adversary of the Jesuits in France (Costa 1967). Instead Frisi succumbed to the flattery of d'Alembert and always defended him, thus lending himself to disappointment, when d'Alembert took a critical position against his dissertation, which we will mention later. It was this partisan attitude of his towards the philosophers that lead Frisi to oppose the Jesuits and their pupils in general. This is also valid with regard to Joseph-Jérome Le Français de Lalande (1732-1807). The latter published an important *Astronomie* , the first volume of which was published in 1764 (Costa 1967, p. 849[11]). Boscovich promptly wrote a critique of this work by Lalande in *Caffé* (Il Caffé 1894) In the intent to provoke interest in this subject in all readers, Boscovich went through all 24 books of Lalande's treatise one by one, insisting particularly on the importance of book XXII, in which the French scholar deals with the theory of universal attraction: Boscovich observes "There is not yet anything elementary or clear written on this subject. M. de Lalande has made the famous problem of three bodies available to everyone [...]" (Il Caffé 1894, p. 247). Boscovich is completely aware that this critique must be considered completely exceptional for a publication such as *Caffé*. However the exception is justified in consideration of the extraordinary importance of Lalande's work (Il Caffé 1894, p. 243,248)

Lalande's *Astronomie* rightly gives vast consideration to Copernicus, with whom he shares many ideas. In the same way Lalande expounds on Newton's theories with great interest and appreciation, which for a great part he shares. On the other hand Lalande is too reticent with regard to Galileo. Of course, this scarce consideration of the Italian scientist must have seemed entirely inadequate to Frisi, who dedicated some pages of *Caffé* to praising Galileo (Il Caffé 1894, pp. 19-29, cfr. Costa 1967, p. 852). Here it is interesting to observe how Boscovich intervenes in defending Lalande, by finding excuses in the fact that he had little consideration for Galileo. First of all, observes Boscovich, Lalande mentioned him with regard to the discovery of satellites, secondly it is obvious that the French in general do not speak of Galileo with the same importance as the Italians (Costa 1967, pp. 853-854).

The potential argument, which hung in the background, between Boscovich and Frisi in regard to unpleasant expressions by Frisi concerning *De lunae atmosphera* by Boscovich, was explosive material that was ignited by Lalande to provoke Boscovich against Frisi (Costa 1967, pp. 862-863). In fact, he said in confidence to Boscovich that they would not have published Frisi's dissertation, *De atmosphera caelestium corporum* (awarded a prize in 1758, as previously mentioned), if Frisi had not agreed to amend it and to correct his unfair judgment concerning theories maintained by Boscovich.

In effect Boscovich, given Frisi's lack of precision and arguments, suspected that the latter had not even read his dissertation. Moreover, he had good reason to believe this, if it is true that Frisi had insisted a good deal to receive this pamphlet directly from him, although he affirmed it had only been lent to him[12]. In actual fact, after having attempted to convince the Milanese Barnabite to retract,

[10] Of the prolific writings of the Jesuits, those attributable to only three men have survived: Guldino (Paul Guldin, 1577-1643); Francesco Maria Grimaldi (1613-1663) and Gregorio da San Vincenzo (1584-1667), all of them of the *Compagnia di Gesú.*

[11] Reference is made to (De Lalande 1764)

[12] Costa 1967, p. 830, 832. Making another supposition, he could have learnt about Boscovich's work also from another critique, such as for example that included in the "Storia Letteraria dItalia",

without success, Lalande excluded Frisi's dissertation from the *Raccolta*[13] of the prize-winning works from the Paris Academy, providing the excuse that it had already been published in Italy[14]. At that point Frisi felt himself to be the victim of a Jesuit plot (Costa 1967, p. 872). It is true he could count on the friendship of d'Alembert, however the latter was well aware of the limits of Frisi as a scientist. Thus there was not equal esteem in the friendship between the two men and d'Alembert made no secret of it (Costa 1967, p. 864).

In effect the mishaps between Frisi and the French Academy were destined to continue. In 1772, on the occasion of the setting up of the prize on the theory of the moon and on the equation of mean motion, a prize in which also Lalande took part, the winners were Eulero and Giuseppe Luigi Lagrange. It appeared that the Academy, whilst much appreciating Frisi's work, found many inexact analyses and calculations(Costa 1967, p. 873). Frisi's reaction, which was expressed in a letter that he sent to the permanent Secretary of the Paris Academy of Science, was violent(Costa 1967, pp. 873-874).

The complete rupture between Frisi and Boscovich, which had matured in the ways that we have examined so far, became apparent on the occasion of a project by Boscovich for improvements to the Brera observatory (1773). Frisi expressed his negative opinion (Costa 1967, p. 875). It was then that Boscovich also gave up teaching at the Scuole Palatine, in order to take refuge in France, when the Society of Jesus was suppressed in Lombardy (Casini 1971, p. 228).

Other differences and controversies between these two scientists active in Milan can be seen by comparing their two different projects for reform of the education system. In order to piece together the context, it is worthwhile recalling some elements regarding the organization of teaching in Milan and Pavia under Austrian domination (Storia di Milano 1959). Control over education was at that time entrusted to the Senate. However, the Senate was too slow a body, also because it was in charge of many other tasks, to be able to manage this important aspect of the cultural education of citizens efficiently. This was the situation of the Academy Ateneo at Pavia and the Scuole Palatine in Milan. It was necessary for the Government to intervene promptly and with determination, so the matter of education was removed from the hands of the Senate. A royal dispatch dated 24 November 1765 set up a Junta, that is to say a special council which was transformed and established in "Magistrato degli Studi" ("Magistrate of Studies"). This situation which arose under the government of Maria Teresa was destined to last until the time of the reforms by Franz Joseph. The Junta was composed of five people who were experts in matters that were practical and useful to civilian society and which were to be taught at a public level. Gian Rinaldo Carli (Capodistria 1720-Milan 1795) was named Chairman[15].

Proposals for the reform of mathematical and scientific courses, put forward between 1767 and 1769, revealed the presence of various teaching and apprenticeship systems which were then in existence in the city of Milan[16]. With the reform of the city's Arts Faculty (intending by this all the schools and apprenticeships of civilian professions), the aim was to complete the practical internship of engineers (meaning by this term also technical professions such as architects, quantity surveyors and land surveyors). This was supposed to have been the reason for the presence of Frisi in the Scuole Palatine. In other words, he was to have the same teaching function envisaged for the *Scolopi* in the Scuole Taverne (Brambilla 1987, p. 408). Instead the reform of the institutional Philosophy Faculty (as much royal as ecclesiastical) was to have another aim, that

Modena, Remondini, 1755, from July to December 1753, pp. 53-57.

[13] This is Recueil of 1771, Costa 1967, p. 872

[14] In effect it had been published in 1759, see above

[15] Cfr. Ibid., pp. 371, 621, 614 note 2. The first Chairman of the Giunta was Count Firmian.

[16] This aspect of educational reform connected to Frisi and Boscovich was closely studied by Brambilla (1987)

is: to correct the obsolescence of the teachings of aristotelian philosophy, by substituting the textual-dogmatic approach with more modern sciences, in other words founded on mathematical and experimental bases. Only after the implementation of these reforms would it have been possible to have converged in one only institutional building the practical-technical tradition of liberal Arts and the high tradition of theoretical science and university philosophy. The implementation of these reforms envisaged the positive result also of the solution to a long-standing problem: the simply additional and/or "ad libitum" character of scientific subjects, which at that time were all left to personal taste and moreover considered a "luxurious" practice, which only few aristocrats could afford to cultivate, as it were, by dabbling in science. This aim of the reform intended to correct the different directions of teaching and the various training methods by finally overcoming the alternative binomial between "facultative" and "compulsory" subjects and between "professional" and amateur teaching which until then had presided as much over the organization of subjects to be taught as the different social classes to which the courses were to be opened. This is to be borne well in mind in order to understand the changes in the scientific-mathematical study plans and in the same internal division of scientific teaching between pure mathematics and mixed or applied mathematics.

Having said this on the general meaning of the reform, it may now be well to take into consideration the two plans for reform proposed respectively by Boscovich and Frisi. Boscovich presented to Gian Rinaldo Carli (Brambilla 1987, pp. 414-415) in 1767 his reform plan for the royal Philosophy Faculty. This envisaged teaching pure mathematics by dividing it into two distinct parts: (1) One elementary part with classical Euclidean geometry and arithmetic, which today would correspond to middle school level and which at that time would have had to be introduced ex novo in Pavia, and (2) a sublime part, covering all types of mathematics, from algebra, trigonometry, infinitesimal calculus, which were what Boscovich already taught in Pavia. Furthermore he proposed teaching applications of astronomy on territorial geography, to be taught with the help of the "Specola di Brera": these studies were not intended for external students, but for internal mathematical astronomers of the Jesuit order. The study plan presented by Boscovich was criticized by Carli, who did not conceive the miraculous leap from elementary Euclidean notions to sublime geometry; furthermore he denounced an inadmissible void: in fact, certain aspects of science (civil and military geography and architecture) were missing, which civil society at that time needed. Carli also proposed to abolish the antiquated teaching of "system physics" (that is the philosophy of the greatest systems in the world of physics). Professors relieved of this superfluous teaching would have been usefully directed to teach Euclidean geometry. As to advanced mathematics, Carli proposed a different division in comparison with that proposed by Boscovich. He envisaged two professorships with two different teaching courses, both lasting two years: Gregorio Fontana[17] was to be given the task of lower teaching of pure mathematics (trigonometry and algebra); while to Boscovich, as the head professor, Carli intended to entrust the teaching of mixed or applied mathematics: astronomy, with its cartographical and general geographical applications, Newtonian optics (that is the range of more advance matters in regard to theoretical physics) and civil and military architecture.

On the other hand, the reform project presented by Frisi to Carli in 1768 had more modest aspirations. In fact he did not intend to elevate Pavia and its Faculty of Philosophy to a main, if not unique, study centre for scientific subjects, nor did he aim to revoke the university privileges of the Milanese "scuole dei ceti". Frisi only suggested closing the schools of philosophy of the regular Orders only in Pavia, not in Milan: he did not intend in any way to close the most prestigious universities, entrusted to regular teachers, which in Milan were competing with those in Pavia.

[17] Gregorio Fontana, christened Giovanni Battista Loreno (1735-1803), scolopio, professor of mathematics at Pavia (Baldini 1997)

Nevertheless, the innovative content of his proposal is rather weak: it required the possibility for a good institutional preparation in Pavia, which could also be substituted with courses to be frequented in Milan and which could have been completed with a three-year course in Pavia and possibly integrated with practical exercises in Milan. In substance, Frisi proposed the introduction of an institutional three-year course, possibly in Pavia, but which could be integrated with certificates from courses frequented in Milan with other public lecturers: furthermore he proposed a two-year course in Milan, envisaged as an internship at the Collegi di mestiere, including attendance at some courses in Brera.

At a closer look Frisi's particular concern was the education of the Collegio engineers, evidenced by his wish to reform their apprenticeships. For them he suggested, after one year of elementary geometry, a two-year course of "mixed mathematics", to be attended either in Pavia or Milan. Only one chair in both Studies was to see to instruction in the chain of mixed mathematics, that is to say: elements of mechanics, hydrostatics, hydraulics, hydrometrics and civil and military architecture. At this point it is important to attempt a comparison between the proposals of the two scientists active on the Milanese scene. Boscovich limited his proposals to the theoretical and facultative sector of sublime mathematics, tending to ignore elementary popular teaching and civil applications of sciences, that is to say their professional and practical applications. Cartographical applications, above all for military use, based on astronomical measuring were envisaged in this plan only in Milan and for pupils of astronomy. Frisi considered as his pupils both the engineers in the Faculty of Arts and the doctors of the Faculty of Philosophy, but his interest somewhat contrasted that of Boscovich: instead of sublime aspects, he tended to emphasise the practical applications, by placing importance on the elementary, public and compulsory subjects for his profession.

It has been rightly noticed that, beyond the evident differences between the two holy men and their different ways of conceiving teaching, there is however a common characteristic. It is probably the mutual heritage of an education which they both received in a religious environment, that explains their consequent habit to treat scientific arguments as facultative and private. From this also derives the idea according to which it would be impossible to overcome the difference and the corresponding gap existing between different types of mathematics: algebra and infinitesimal calculus, on the one hand, and qualitative physics and natural geography on the other. From their projects there is no hint that the barrier between advanced research and professional disclosing can be destroyed, between public teaching and "silenzio del tavolino" [18]. The ex-professor of nautical subjects Gian Rinaldo Carli, who had a more Mittel-european rather than Italian mentality, appeared more sensitive to the possibility of this integration.

To be more complete I shall just touch on a final reason for argument over which the two Milanese scientists measured themselves. This was the famous controversy over the main spire of Milan Cathedral. Without going into the details, I would just point out that Frisi was the only person to advise against the building of the new spire, warning those in charge of the Fabbrica against the danger of lightning. It is interesting to note how, of those consulted, one of his fellow brothers, the Barnabite Francesco de Regi, a lecturer in mathematics at the Arcimbolde, had expressed a favourable opinion, as in any case Boscovich himself had[19].

As can be seen, from all the arguments between Boscovich and Frisi over many subjects, it is possible to have a precise idea about the lively cultural environment of religious men who at that time were involved in the slow transformation of study and teaching methods. Apart from petty discussions connected most of all to their different char-

[18] Eloquent allusion to the private education system, mostly offered by the teacher to a single pupil

[19] On this whole matter I refer to the work of the count A. Nava (1845). Nava does not only recount the subject from an historical point of view, but publishes in their entirety various opinions of scientists consulted on the matter.

acters, one of the most typical traits of the Lombardy Enlightenment emerges from their writings and their discussions: it was certainly not a matter of denying God nor Christianity, but it was however necessary to find and pursue new rational paths which made the beauty and depth of Christian values newly accessible to the minds of men, which were then overcome by the fascination of scientific knowledge, including the necessity to transform earthly cities by using all the tools that theoretical knowledge could offer to real everyday needs.

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