Science in the Shadow of the Vatican

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We may construe the phrase “science and religion” in two main ways. One is institutional: the relationship between established churches, with their doctrines, politics, and hierarchies, on the one hand, and the organized pursuit of natural or historical knowledge, with its own set of authorities, on the other. The second construal is personal or psychological: the relationship between the demands of science and the claims of faith in the minds of individuals. The institutional relationship is always in potential conflict, and should be, since established churches and organized science owe allegiance to different authorities and beliefs. Individuals, however, can diminish potential conflict and often nullify it by accommodation, compartmentalization, dissimulation, or nescience. The last technique denies that human beings can resolve the deep riddles and contradictions of our and nature’s existence, and allows the person of faith and science to pursue both in the confidence that, in the inscrutable mind of God, all truth is one. Nescience is not skepticism. It can support open and enthusiastic commitment to a theory as the truest and most faithful available representation of the facts of experience. It does not place all representations on the level of mere hypothesis, more or less convenient, but otherwise equivalent.

In this paper I discuss the adjustments of three men of faith and science to the conflict between established religion (the Roman Catholic Church) and academic freedom (the Republic of Letters). My protagonists though little known today all had international, that is, European reputations as savants in their time. The oldest, Geminiano Montanari, was born in 1633; the youngest, Lodovico Antonio Muratori, died in 1750; hence their combined careers span a century, from around 1650 to 1750, a period of particular interest in the relationship between the Catholic church and the Republic of Letters. The third man in the story, Francesco Bianchini (1663-1729), was Montanari's favorite student and disciple, and, for a time, Muratori's role model. All three were devout Christians. Again Bianchini occupied the middle ground. Educated at the Jesuit College in Bologna and then at the University of Padua, he took minor orders and began his career as a librarian. Muratori, educated by the Benedictines, became a priest and spent his life as an archivist and letterato. Montanari studied abroad, returned to become a professor, and remained a layman.

It would be a mistake to limit science to the study of nature during the century 1650-1750. The historical sciences then underwent a revolution in method and substance no less significant than the natural sciences did. This revolution held greater interest for the Roman establishment than the more familiar one in science since it stimulated the archeology, and criticized the received history, of the early church. All our protagonists took an interest in history as well as in natural science. Montanari was primarily an astronomer and natural philosopher, Muratori overwhelmingly a historian, Bianchini an astronomer, historian, and archeologist. In the middle again, or rather the center, Bianchini worked in Rome, under the patronage of several popes, whereas Muratori made his career in Modena in the service of the local duke and Montanari his in the universities of Bologna and Padua. For these

reasons –his intermediary position in time and subject matter, and his central position in Catholic space– Bianchini's life and work make an excellent guide to science in the shadow of the Vatican.

From Montanari, Bianchini learned that a pious Catholic could cultivate up-to-date natural science, though at the cost of affirming some principles and approaches proscribed by his church. The affirmation was made conceding the ultimate incomprehensibility of it all. Montanari's nescience or agnosticism served Bianchini well before he settled definitively in Rome in 1688. Then he found it useful sometimes also to practice dissimulation (treating an idea as if true while denying accepting it), accommodation (discounting inconvenient scriptural passages about natural phenomena as simplifications intended for the uneducated Hebrews), and compartmentalization (ignoring conflicts). These techniques and his rigorous discharge of his duties as a deacon and a Christian helped to protected Bianchini's science from the censorship, which he sometimes served as a consultant. He knew his way around the Roman establishment, "a little saint, and every inch a courtier."[1]

1. Preparation

Bianchini's mathematics teacher at the Jesuit College in Bologna was Giuseppe Ferroni, a Galilean sympathizer gagged by his Order's orders to teach only Aristotle in philosophy and to observe the Inquisition's edicts against Copernicus. The gag did not silence Ferroni altogether. He taught Bianchini the Copernican system and the fine art of dissimulation. Bianchini was impressed, and wanted to join the Society. But his father, thinking him too young for such a decision, sent him to Padua, the university town of Venice, where he found an entirely different approach to natural knowledge.

Dissimulation

By the time that Bianchini entered college, the Jesuits were teaching heliocentrism as an hypothesis contrary to the truth as established by the Inquisition but nonetheless convenient for describing the motions of the planets. They preferred the Tychonic system, in which the planets circle the sun and the sun goes around the earth. By then, 1670 say, no knowledgeable person accepted the pure geocentric view of Ptolemy as a satisfactory representation of planetary motion; Galileo's discovery and explanation of the phases of Venus had limited the useful application of geocentric astronomy to the sun, moon, and stars.[2] Ferroni was not satisfied with Jesuitical fictionalism. To express his frustration he wrote a dialogue starring the brilliant young Bianchini and a fellow student who did become a Jesuit.[3]

Adimento, that is, Bianchini, opens the discussion by observing that the freedom with which Copernicus had spoken about his heliocentric world with the encouragement of several bishops and a pope no longer obtained. More expert exegetes had since discovered that "divine Scripture speaks only too clearly about the

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Letter of Enrico Noris to Antonio Magliabecchi, 7 June 1698, quoted in Heilbron, *Sun* (1999), 154; for the *cattolico illuminato* protected by his piety, see Ferrone, *Giorn. crit. fil. Ital., 61* (1983), 4, and *Roots* (1995), 62.

[2] Heilbron, in McMullin, *Church* (2005), 291-8.

[3] Ferroni, *Dialogo* (1680).

rest of the earth and the movement of the sun." "Silvio" replies that he prefers fiction to fact and Copernicus to all others. Adimento reminds him of the danger of the doctrine. Silvio admits that he has flirted with heliocentrism only to develop a clinching argument against it. Adimento says that he has done the same. The two apprentice astronomers then give a clear and thorough account of the system they propose to demolish. Their "novel" arguments were variations on standard physical objections that all knowledgeable people knew could neither cancel Copernicus nor establish Tycho. Ferroni understood his subject well. His dialogue was a dissimulation. It taught Copernican theory while appearing to support the ban against it and illustrated the negative consequences of declaring heliocentrism erroneous by the ignorant arguments his bright students invent. How else to protest? As Ferroni explained himself to Galileo's last disciple, Vincenzo Viviani, he could scarcely write openly about astronomy or natural philosophy "with the chains of Aristotle around his feet."[4]

Bianchini was to use the Copernican conception in much of his astronomical work. At first, he expressed no opinion about it, partly because he published few of his early observations and saw no reason to trouble the world with his views on controversial matters. One early piece he did publish was a simplified description of a method of determining planetary parallaxes invented by Gian Domenico Cassini. The description does not mention world systems, but in his manuscript notes for it Bianchini gave as an important feature of the method that it did not rely on heliocentrism.[5] However, he came to think so naturally in Copernican terms that late in life, on one unguarded occasion, he remarked that he had to break off his observations of Venus because "the earth's rotation carried it to a part of the sky obscured by [a building]." He published these observations in 1728 with an analysis that placed the earth, like Venus, around the sun. Still he dissimulated: he had employed the prohibited system solely on the ground of convenience, he said, since the same diagrams would have been 75 percent larger if presented to the same scale on Tycho's system. For this transparent subterfuge he was praised by the censorship and censored by the secretary of the Académie royale des sciences of Paris, of which he was a foreign member. But although Bianchini hid his worldview in public, he pushed it gently in private. He worked behind the scenes to promulgate Newton's *Principia* and to search for the stellar parallax that all astronomers agreed would, if found, destroy the alternatives to the Copernican system.[6] Still, he would not agitate even privately for the repeal of the condemnation of heliocentrism. He did not take advantage of his closeness to Clement XI (1700-21) to try to free the letterati of Italy from (as his friend Leibniz put it to him) the "chains by which in science, especially astronomy, they are tied to the ground."[7]

Nescience

Although Bianchini's main study in Padua was theology, he followed Montanari's lectures and demonstrations assiduously. These taught a "fisicomatematica" that consisted of the experimentalism of the Accademia del Cimento, Galilean mechanics and astronomy, and an eclectic corpuscular philosophy

[4] Ferroni to Viviani, ca. 1683, and 12 May 1672, in Torrini, *Physis*, *5* (1973), 414, 418.
[5] Bianchini, in *Acta eruditorum*, 1685, 470-8, and FB(V), cod. ccccliv:v, ff. 87-92.
[6] Heilbron, in Kockel and Sölch, *Bianchini* (2005), 77-82..
[7] Heilbron, *Sun* (1999), 197.

in Boyle's style. Montanari had begun to develop this mix while a professor at the University of Bologna, when he first took up with the philosophy of that "bizzar genio francese," René Descartes.[8] Montanari felt constrained at Bologna and, despite his love of controversy, censored himself lest others do it for him.[9] In Padua he could teach, write, and proselytize more freely. Still, he took the trouble to protect the territory he claimed for reason with an apology that distinguished the truths at which physics aimed from the certainties of faith.

Bianchini became a missionary in this cause. His first converts were doctors (the "Aletofili") in his hometown whom he advised on the establishment and conduct of an academy of experiments. In 1687, the year of Montanari's death, he told the Aletofili that natural philosophy does not aim to define objective truth, but to construct a "mental world of knowledge and understanding." This mental world gave a portrait, an accurate and suggestive description of the physical world, rather than the caricatures and chimeras of the Aristotelians. A successful world portrait "must be based on principles sketched from nature, colored in with evident demonstrations, and displayed publicly, on the understanding that it may be improved on every just demand of experience."[10] Here we have the manifesto of the scientific revolution in a sentence: public knowledge, demonstrated by experiment and constantly amendable as new experience requires refinement of principles and revision of consequences. The natural philosopher should have complete freedom in inventing his principles. Using this cardinal right of the Republic of Letters, modern philosophy has insisted on a minimal approach utterly destructive of the school philosophy. It strives to "reduce the causes of all sense experience to a few clear principles," namely figure, quantity, and motion, which it uses in the same way as axioms in mathematics.[11] By easy implication, Scripture, dogma, and the unanimous consent of the fathers have nothing to say about science, and the biblical passages apparently bearing on it must be ignored or interpreted in an accommodationist manner.

The natural philosopher recognizes that, because his science rests on sense experience, it contains much that is uncertain. It is a grave error, committed by many expounders of the corpuscular philosophy and even by the bizarre genius at its fountainhead, to descend into the "foundry of caprice" where misguided philosophers imagine the sizes and shapes of the ultimate particles. By calculating the dilution of the silver layer coating a piece of copper wire when the wire was drawn out, Montanari obtained an upper limit to the size of elementary particles of silver; good philosopher that he was, he stopped there, and did not indulge in guesses at their true size and shape. Nor did he give the cause of their cohesion. Like Borelli and Boyle, Montanari contented himself with suggesting a probable mechanical cause, "not daring [, however,] to call it true."[12]

Bianchini ended his harangue with an assertive note, often played by the letterati of the period, which to modern ears sounds nationalistic. He remarked that the experimental inquiries of Boyle, Redi, and Malpighi, and the sound methods of

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[8] Heilbron, in Acad. Ver., *Mem*. (in press).; Montanari, Acc. dei gelati, *Prose* (1671), 301, and *Forze* (1684), 112.
[9] Heilbron, *Sun* (1999), 187.
[10] Bianchini, *Nuova racc., 4* (1785), 4-5, 21.
[11] Ibid., 8-9.
[12] Ibid., 14-15, 18.

Galileo and Borelli, had given the seventeenth century a reliable "outline of nature." We need only fill it in, Bianchini told his fellow Aletofili, and Italy will be in the van again. History is with us. "The philosophy brought to Italy by Pythagoras from Egypt and Greece, and buried there with the Roman republic, came forth again with the birth of Galileo, and is now close to delivering immortality to the Italian name."[13] This incongruous appeal to the standing of Italian culture was not intended to stir up feelings of nationalism among letterati but of forebearance among censors. Men who wrote in Italian could hold their own in European science if the censorship left them alone.

Like his one-time friend Ferroni, Montanari liked to teach via dialogues composed for his students. Bianchini thought one of these important enough to publish after Montanari's death. It concerned the great question of the nature of nothing. The interlocutors are Galileo, Gassendi, and Montanari. The junior sets the stage.

> MONTANARI: O great Galileo! O famous Gassendi! I have read the invective you rightly direct against philosophers who hate like the plague the phrase 'I don't know.' What then can I tell my students about the vacuum in the barometer tube and the receiver of an air pump?
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> GALILEO: Do you understand the infinite?
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> MONTANARI: I understand only that I do not have the intellect to understand it.
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> GALILEO: Bravo! …You have learned everything that can be learned about the infinite. No satisfactory solution can be found for questions like the existence and extension of space and the nature of the void, since they involve the incomprehensible idea of infinity. Don't worry yourself over such questions, –Galileo advised his disciple–. They arise from an undisciplined "hankering after knowledge."[14]

2. Adjustment in Rome

In Rome, where he arrived to study law after graduating from Padua as bachelor of theology in 1684, Bianchini again tempered his attention to his formal studies by cultivating the natural sciences. He joined the Accademia fisicomatematica romana underwritten by a curial official, Monsignore Giovanni Giusti Ciampini. There he met some leading foreign scholars, notably Jean Mabillon, Europe's authority on the authenticity of historical manuscripts, and Leibniz, who took the opportunity of his visit to Italy in 1689/90 to try to convince high-placed ecclesiastics that, since motion is relative and cosmological systems conveniences, all parties to the heliocentric dispute were equally right and wrong. No doubt Bianchini looked favorably on this irenic agnosticism. He was then still propounding Montanari's philosophy. Probably around the time of Leibniz' visit he drew up a dialogue on Montanari's corpuscular theory of fluids and another on the manner in which sound travels in air and "vacuum."[15] He may well have sailed too close to the heretic Leibniz and the condemned corpuscularism for Roman tastes. Rumors circulated that

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[13] Ibid., 36-7.

[14] Montanari, in Altieri and Biagi, *Scienziati* (1980), 525, 528-32, 535.

[15] BP(V), cod. cccliv:8, ff. 177r-205v, and cod. cdxxxviiic:20, ff. 475-8.

he inclined toward libertinism.[16] Perhaps for this reason, as well as for career considerations, he turned his attention from Montanari's subjects to quite another line of work – erudition, history, archeology,

Roman "physico-mathematics"

The dominant figure at the Accademia fisicomatematica in the 1680s, apart from Ciampini, was Francesco Eschinardi, professor of mathematics at the Jesuit Collegio Romano. In 1680 Eschinardi published an account of experiments, many of which he designed and analyzed, performed at Ciampini's meetings. It opens boldly by correcting one of Galileo's propositions about levers.[17] Nonetheless, Eschinardi followed Galileo's lead in mechanics in most respects, including the kinematics of free fall and projectile motion.[18] He deployed his nasty tactic of magnifying Galileo's trivial mistakes while making use of the main results of *Two new sciences* on several other occasions. His confrère and fellow academician Antonio Baldigiani, S.J., sometimes joined in this derogatory campaign and once (at a meeting in March 1678) declared that he saw no reason to abandon Aristotle's principles of natural philosophy.[19] In this way the Jesuits sought to separate atomism and corpuscularism, with their perilous savor of materialism, from *fisicomatematica* and to show that much remained to be done to improve the safe sciences that Galileo had begun.

Almost half of Eschinardi's account of the work of the Accademia fisicomatematica deals with traditional non-controversial mechanical subjects, like load-bearing wheels, the operation of the rudder, and the improvement of clocks.[20] A physical-mathematical academy could not do without astronomy, however, and Eschinardi reported a proposal by Ciampini to build in Rome a great meridiana for the exact observation of the solstices and equinoxes, as Cassini had done in Bologna, a project later accomplished by Bianchini on commission from Clement XI. There were also discussions of current problems in observational astronomy: how best to determine atmospheric refraction, observe eclipses, measure the moon's libration, diversify gnomonics, and so on.[21] Nor could Eschinardi avoid mentioning the Torricelli experiment. But here, where Montanari and other third-generation Galileans clasped Boyle to their bosoms and made pneumatics an anchor of corpuscularism, Eschinardi declined to enter. He would say only that the appeal to flexible particles and interstitial vacua had its difficulties, since the flexibility in turn would need a mechanical explanation, which would involve smaller flexible particles and smaller vacua, and so ad infinitum.[22]

During the 1690s the Accademia fisicomatematica would have been bold indeed to move beyond the limits defined implicitly by Eschinardi's account. Alexander VIII (1689-91), whom, when Pietro Ottoboni, Bianchini served as

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Robinet, *Nouv. rep. lett*., 1991:2, 18, and *Iter* (1988), 54-62, 81-118.

[17] Eschinardi, *Raguagli* (1680), 3-6, repeated in Eschinardi, *De impetu* (1684), 77-9; the correction concerns the first figure in the second day of Galileo's *Discorsi*, in *Two new sciences* (1974), 114.

[18] Eschinardi, *Raguagli* (1680), 24-5. and *De impetu* (1684), 21-4.

[19] Rotta, in Di Palma, *Cristina* (1990), 139-40; Torrini, *Dopo Galileo* (1979), 41-77; Eschinardi, *De impeto* (1684), 76-7.

[20] Eschinardi, *Raguagli* (1680), 12-19, 25-7, 29-3.

[21] Ibid., 30-5.

[22] Ibid., 60-1.

librarian, was a former inquisitor and strict constructionist. Persecution extended to some of Bianchini's friends who called themselves the Congresso medico romano, and who accepted the moderate corpuscularism of Boyle, Montanari, and Borelli.[23] Their persecution by Alexander's reinvigorated inquisitors distressed Bianchini, whose sympathies lay with his friends and fellow travelers but whose loyalty belonged to Ottoboni, who was his patron as well as his pope.[24]

Bianchini continued as the Ottobonis' librarian during the 1690s, immersed in "universal history" and distant from, though not indifferent to, the crackdown on "atheistic" (*recte*, Cartesian) intellectuals in Naples and Rome during the early years of Alexander's successor Innocent XII (1691-1700).[25] In 1693 the leading member of the Congresso medico romano, Giovanni Maria Lancisi, signaled an easing in a lecture in Rome on the proper method of philosophizing in medicine. He defined natural philosophy as an "activity of the human mind regulated by indubitable geometrical and mechanical principles, and by physico-mechanical and chemical experiments." He added that it should be pursued for the improvement of medicine without seeking the "primordial elements of the atoms of Democritus and Epicurus" or (so it was understood) consulting the Holy Office. The following year, 1694, Bianchini issued Montanari's dialogue with Galileo on the nature of atoms and void.[26] What further Bianchini might have done to assist the relaxation of hostilities privately or in Ciampini's academy is not easily determined because few of the manuscripts in his vast literary remains are dated. In any case he had enough to do writing, illustrating, and publishing his great contribution to historical method, his *Istoria universale* (1697).

Universal history

Bianchini composed his history with as little reliance as possible on the ordinary documents of historians.[27] He did without historical accounts, even from Scripture, in favor of coins, medals, sculpture, inscriptions, and other material relics. He developed a theory of the perseverance of meaning of symbols that allowed him to move from a late depiction of a mythical figure or traditional event to the historical significance of the time it commemorated. He would turn to the copied and recopied writings of ancient historians only as necessary, which proved in practice to be frequently. No more was he able to make good altogether on his plan to write the history of mankind from the creation to the year 1600 without reference to the Old Testament – not only because he grew tired of the project when only 3200 years into his tale, but also because his learning often discerned parallels between Hebrew patriarchs and pagan heroes, for example, Moses and Mercury, which he could not forebear to mention.

The dating of the Creation, the Flood, and the voyage of the Argonauts will indicate the comfortable and complementary interaction of science and religion in Bianchini's historical method. Indeed, the harmony may appear astonishing. Ancient

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[23] Donato, *Nuncius, 18* (2002), 75-83.

[24] Mazzoleni, *Vita* (1735), 14-17, 24-8.

[25] Heilbron, *Sun* (1999), 96-7, 217-18; Donato, *Nuncius, 18* (2003), 84; Ferrone, *Roots* (1995), 49.

[26] Lancisi, "Sul modo di filosofare nell'arte medica" (1693), quoted in Donato, *Nuncius, 18* (2003), 85; Montanari, *Forze* (1694).

For this section, Heilbron, in Biale and Westman, *Thinking impossibilities* (in press).

histories and artifacts show that all peoples believed in a creation. When did that occur? About 4000 years before the reign of Cesar Augustus. The date conveniently agreed with that deduced by savants of the seventeenth century like Bishop Ussher from toting up the begats in the bible. The trick was to do it without reference to Scripture. Bianchini observed that excavations around Mount Vesuvius had run into moist soil a distance *x* below ground level. Assuming that the soil above it had been deposited at the same rate before the destruction of Pompeii in 79 A.D. as afterward, the rule of three gives the date at which the moist layer was laid down. It worked out to be around 2350 years before Augustus. Bianchini made the obvious assumption that the moisture remained over from the Great Flood, of which we have reports from many sources other than the bible. If the assumption had any merit, the moist level should be present everywhere, like the platinum-iridium band at the cretatious/tertiary boundary, and wetter than the level under Vesuvius, which had been baking in a volcano for 24 centuries before its discovery. Bianchini recognized the desirability of confirming his conjecture by digging elsewhere, which still would make a good research project in creation science. Bianchini's date for the Flood agreed almost exactly with the painstaking computations of the biblical chronologists.

It remained only to calculate Creation. Bianchini required a datum, which he obtained from an ancient historian, and an optimistic principle, which he devised himself. The datum, from Marcus Terrentius Varro: it took the Greeks 1000 years to advance from ignorance to high civilization. Bianchini's principle: on average, all peoples make equal progress in equal times. We may assume that the primitive Greeks started from a higher level of civilization than the first men, for the Greeks had the advantage of the knowledge of farming, husbandry, and shipbuilding that survived the flood. Therefore the first men probably would have needed more than a millennium to advance from savagery to the civilization destroyed in the Flood. Let us say half again as long or, so as not to rush them, 1600 years; as Bianchini the mathematician observed to Bianchini the historian, it is useless to be precise in such matters. But on the reasonable assumption that the Flood occurred 1600 years after Creation, and the Flood 2350 years before Augustus, the interval between the inventions of the earth and the Roman Empire worked out to be around 4000 years, close enough to the biblicist calculation to give us confidence in both.

A key event in Greek history and chronology was the voyage of the Argonauts. Knowing its date allows us to fix the time of the adventures of Hercules and other heroes, and of Aeneas and Ulysses. Not that Bianchini believed in the gods of Greece; he held rather the euhemerist principle that the old myths represented stories about real people magnified by their descendents. To date the launch of the *Argo*, Bianchini again invoked a datum and a principle. The datum, the Farnese globe, is a copy made around 150 A.D. of a much earlier original. It bears images of the constellations and reference circles indicating the ecliptic, equator, and equinoctial colure in the second century. The principle was that the original of the globe dated from the time the constellations on it were first devised. None of these asterisms refers to a time subsequent to the era of Jason, Hercules, Cheiron, Theseus, and their colleagues. Hence the inevitable conclusion: the maker of the Farnese globe copied, at one or several removes, the apparatus with which Cheiron taught Jason how to navigate by the stars.

The knowledge that the original of the Farnese globe was a relic of the Argonauts does not supply a date for either. The historian turned to the astronomer. If Bianchini knew where to draw the equinoctial colure in Jason's time he could calculate from the known value of the precession of the equinoxes how many years before 150 A .D. the *Argo* set sail. According to the Greek astronomer Eudoxus, who lived at the time of Aristotle, the earliest masters of the sphere drew the colure through the centers of the asterisms Aries and Libra. Cheiron would have placed the vernal equinox in the heart rather than the horn of the ram. Measurement along the ecliptic from the equinox of 150 A.D. depicted on the Farnese globe to the center of the ram gave a certain arc; multiplication of the arc by 71, the number of years required to precess one degree, gave 1425 years, whence the voyage of the astronauts took place around 1275 B.C., close to its traditional dating in Greek sources. There was some leeway in the calculation since the middle of a ram roughly carved on a stone sphere is not clearly defined; but the result no doubt is more secure than Bianchini's estimate of the epoch of Creation.

It is hard not to be impressed by Bianchini's effortless movement through mythology, archeology, and astronomy to results that touch on issues of great importance to Catholic teachings, which, though always in the background, never appear explicitly in the reasoning. No matter that the results are wrong, from beginning to end. The important point is that Bianchini could exploit the method, which had within it the capacity to undermine belief in Scripture, without any impediment, internal or external. The danger is obvious in retrospect and was perhaps plain enough then: from the treatment of pagan sources as competent to produce the same creation story as Scripture, and the same general outline of human history, it was an easy step to reduce the Mosaic account to the same level as the epic of Gilgamesh. Ascribing any credibility to the annals of the Chinese, Egyptians, or Babylonians, who boasted an antiquity far greater than that claimed by the Greeks or the Jews, inevitably strengthened belief in the existence of men before Adam. Of course Bianchini did not pursue the challenges to Scripture as a true account of human history implied by his Istoria universale..

3. Faith and Science

Although he enjoyed the rank of a Monsignore, to which he was raised by Clement, Bianchini would not proceed beyond the deaconate. He had demonstrated his commitment to the church by taking minor orders and the priesthood exceeded his ambitions. He preferred the work of a scholar to the duties of a priest and did not relish the rough-and-tumble competition by which a man without family influence advanced through the church hierarchy. However, he did not forget his training in theology and canon law. From time to time he gave sermons and homilies to popes and cardinals and defended papal claims and privileges from usurpation by rival princes.

Religiosity

Bianchini began preaching in the Vatican soon after coming to Rome in 1684. (An introduction by Cardinal Pietro Ottoboni may have been the route.) Probably the first such occasion took place in 1685 when, at the age of 23, he gave a sermon on the mystery of the Trinity in the presence of Innocent XI. The theme was reason, religion,

and love. We are not to worship as automata, Bianchini told the the pope and his cardinals, but as sensitive and sensible beings: "Iam non servos vocat nos Dominus, sed amicos." Love and knowledge are equal in God, "each is an act of God, each is God." "And thus," the newly minted theologian and accomplished astronomer concluded, let us have both faith and reason, "let us love to know, and know that we may love."[28] Apparently the sermon won approval. Bianchini was invited back to give the final funeral oration (the *novendiali*) for Innocent in 1689. He liked the subject, since Innocent too was a pious man, eventually beatified, though not on the strength of Bianchini's oration.[29]

In a meditation on the significance of the Cross, delivered in 1707, Bianchini explained the concept of beatitude using the same abbreviated philosophy of science discoverable in his sermon of 1685. "Beatitude is the internal conformity of reason to the beloved object, and its correspondence…with the idea impressed in the soul by the serene diffusion and working of the Creator within us." The Cross is an instrument for attaining beatitude. Thus spoke the theologian. The mathematician elaborated: meditating about the Cross can shape us "just as a knowledgeable craftsman, by applying his exact instruments to a tower falling into ruin, can reduce it to just proportions with right and equal angles." And finally the courtier: The Cross has triumphed everywhere, "over the diadems of monarchs and the laurels of the Caesars," while those who cleave to it, who meditate about it, "will learn axioms of celestial knowledge unknown to the most cultivated academies of Alexandria and Athens."[30]

The Vatican valued Bianchini's religious thought and judgment enough to chose him to advise the College of Cardinals as it entered the conclave to choose a successor to Clement XI. "You see the power of Italy diminished everywhere," Bianchini told the electors. "Affairs in the East are more happily begun than ended; elsewhere, things are either too little ordered or too much dispersed. Arbitration of treaties, allotment of kingdom and serfdom, names and offices that once were native to this city and this See, now seem strange and foreign." We must recognize that the popes will never regain their temporal dominion. "Let us not seek these things, let us not fight for possession of things that people contest with iron, fire, and ambition. Let us defend the cause of moderation, not of occupation."[31] With Bianchini's advice and divine inspiration the cardinals chose an experienced administrator who immediately set about conciliating the great Catholic powers and disciplining the Jesuits.

The censors of books also prized Bianchini's religious insight and scientific and judgment, as appears from their enthusiastic approval of his posthumous *Opuscula varia*, a collection of applied mathematics, miscellaneous erudition, and pious meditation. Together the essays showed (as one censor put it) that Bianchini had managed to unite "a very well regulated mind with the deepest learning and a singular piety." Another censor, Thomas Le Seur, co-author of an important edition of

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[28] Bianchini, *Oratorio* (1685), B L 1572/868(1).

[29] Uglietti, *Erudito* (1986), 113. Beatification proceedings, begun under Bianchini's patron Clement XI in 1714, succeeded in 1956, after the French, who had blocked the business because of Innocent's fight with Louis XIV over the investiture of bishops, had decided to let bygones be bygones. Kelley, *Popes* (1986), 288.

[30] Bianchini, *Opuscula* (1754), *2*, 8-9, 13-14.

[31] Quoted in Uglietti, *Erudito* (1986), 113-14.

Newton's *Principa*, inculcator of moral theology at the normal school for spreading the faith (Propagandi fidei), and professor of mathematics at the University of Rome (Sapienza), gave his authoritative assurance that Bianchini's religious essays showed "true piety" and the others depth of learning and clarity of thought.[32]

Bianchini had displayed the same qualities as an advisor to the Master of the Sacred Palace (the Vatican's in-house censor). Most of his reports could serve as models for assessments of submissions to a university press today. They point out errors, supply additional material, and suggest reformulations to improve accuracy and clarity. Once he criticized passages in a manuscript by Mabillion that relied on shaky documents. The apparatus of the censorship thus kept the founder of the art of criticizing documents from making an embarrassing mistake. Bianchini sent Mabillon a list of corrections and Mabillon returned sincere thanks.[33]

Less happily, Bianchini advised against the publication of a book by Mabillon's leading Italian disciple, Benedetto Bacchini. The book was a learned edition of the unique manuscript of the *Liber pontificalis* by the ninth-century chronicler Agnello Ravennate. Agnello gave sketches of the lives of the bishops of Ravenna up to his time, decorated with the usual anecdotes and holy stories, and marred by omissions, contradictions of fact, confusion of names, and a barbarous style. Still, the sketches contained historical information not otherwise known and, with enough learned purgation, could safely be made public. However, the book was based on a faulty and maybe fatal premise. Agnello claimed that Ravenna enjoyed the right to appoint its own bishops and do its ecclesiastical business independent of Rome. Here Bianchini's closeness to the Vatican may have caused him to overstate Bacchini's faults.[34] Bianchini the canon lawyer combined with Bianchini the ecclesiastical historian to condemn Bacchini for not doing enough to refute Agnello's claim, which was not only false but dangerous, and impossible as the premise for a book approved by the Catholic church. Bacchini's prize student Muratori took up the fight and with the help of friends in Rome managed to push *Agnello* through the censorship after Bacchini corrected it to meet Bianchini's objections.[35] In its printed version it signals Agnello's general confusion and blunders in order to discount "his attacks on the most holy Roman pontiffs, and his questioning of their rights over the bishops of Ravenna." These advertisements satisfied the censors, who now found Agnello to contain nothing prejudicial to faith, "but rather a sound and lucid doctrine," or against good morals, "which rather it shapes and teaches."[36]

There is another *Liber pontificalis*, a ninth-century compilation by one Athanasius Bibliothecarius, which does deal with the popes of Rome. It had served as a vehicle for the scholarship of two of Bianchini's earliest patrons, the Vatican librarian Emmanuel Schelestraten and the Vatican lawyer Giovanni Ciampini. Around 1717, at the request of a Roman publisher, Bianchini undertook to edit the book again. His overkill – his *Atanasio* filled four large quartos – may be regarded as a demonstration of how a true and responsible scientist goes about editing old sources of ecclesiastical history. Bianchini's main office was to straighten out the chronology

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[32] G. Cenni and T. Le Suer, in Bianchini, *Opuscula* (1754), *1*, iii.

[33] FB (Ver), cod. ccccxxx:v, ff. 146-71.
Caracciolo, *Passionei* (1968), 53-5; Andreoli, *Benedictina, 6* (1952), 60.

[35] Bacchini in Muratori, *Scriptores 2* (1723), 8-9; Waquet, in Boutier et al., *Naples* (2005), 644-5.
Bacchini, in Agnello, Liber (1708), 3, and imprimatur.

and to annotate the text, as his predecessors had done. In his preface to the first volume, Bianchini called attention to the international scholarship mobilized to make *Atanasio* a reliable source. All nations distinguished in the Republic of Letters had contributed and might do still more by offering their second thoughts for incorporation into later volumes. "I think nothing is more desirable than a collaboration of experts working together to come as close as possible to the truth accessible to well prepared minds." Bianchini ordered his well prepared mind with five rules for the determination of chronology. They make no reference to Scripture. The most reliable sort of evidence, to be preferred to all others, are public monuments placed and maintained by appropriate officials. The next best authorities are the consensus of men known for their knowledge and accuracy, and exact agreement between reported dates and retrospective astronomical calculations.[37]

Buon gusto

"I am reading with the greatest pleasure abbé Bianchini's ancient history demonstrated by bas reliefs, etc., and it seems to me a very big and noble idea." Thus Muratori wrote to a fellow librarian, Antonio Magliabecchi, in September 1698, about the then new *Istoria universale*. He was so impressed that he took the trouble to journey to Rome to meet Bianchini.[38] In 1704, he praised Bianchini's latest book, *De kalendario* (1703), as a further example of the older man's "incomparable erudition and acuity." This flattery disingenuously greased a request to assist in clearing Bacchini's *Agnello*, which then hung in the balance.[39] Despite this tension, Muratori picked Bianchini as the exemplar and president of a set of Italians he, Muratori, had selected for their scholarly good taste. This group, which was to be known as the Accademia letteraria d'Italia, would exhibit and practice the *buon gusto* that, according to Muratori's reform program, would bring the arts and sciences in Italy into the eighteenth century.[40]

He acted with neither taste nor tact. Writing under an assumed name, he announced plans for the formation of the academy, proposed its initial membership, and specified Bianchini's role in it without consulting him. Bianchini refused the honor, criticized Muratori's tactics, and rejected altogether the notion that Italians should set up a competitor to the universal (that is, European) Republic of Letters. No doubt he recognized that the invocation of cultural nationalism was in part an attack on the censorship and thus on the authority of the church, and also that Muratori was trying to use him and the proposed academy's *libertas philosophandi* as leverage on Bacchini's *Agnello*.[41] Nonetheless, we can learn something about Bianchini's image in the world of learning, as well as about Muratori's opinions, from his identification of Bianchini as a man of *ottimo gusto*, able to balance the demands of his science and his faith to within half a scruple.

Buon gusto is the capacity to discriminate the true from the false, the useful from the trivial, the correct from the traditional, an opinion from its author. It brings

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Bianchini, in Athanasius, *Liber* (17[2]1), 1, f. e2v, lxiv-lxix.

[38] Muratori to Magliabecchi, 10 Sep and 1 Oct 1698 (quote), in Muratori, *Epist.* (1901), *1*, 335, 333. Bianchini sent Muratori a copy of his *Istoria universale* (ibid., 301, 19 Feb 1698).

[39] Muratori to Bianchini, 20 Dec 1704, in *Epist.* (1901), *2*, 737-8.

[40] Waquet, in Boutier et al., *Naples* (2005), 637-44.

[41] Bianchini to Muratori, 7 Feb 1705, in Bertelli, *Erudizione* (1960), 81-2n.

the tools needed to select and direct the products of erudition. Consider historical writing. Although it is desirable and praiseworthy to collect, decipher, and publish medals, inscriptions, diplomas, pictures, sculptures, and manuscripts that might otherwise be lost, it is wasteful to pile up facts tastelessly, without order or discernment or principle, as medieval chroniclers did.[42] The basis of historical reconstruction must be documents purged and proved in the manner of "the heretic" Mabillon and his followers,[43] and the historian should consider every aspect of human life, laws, customs, arts, sciences, religions, as well as dynasties, wars, and lower matters. He should not merely compile facts, however, but also arrange them in accordance with strict and broad philosophical principles.[44]

In respect to all these criteria, Banchini's *Istoria universale* scored highly, indeed, is exemplary, in both method and content. A similar may be made of Bianchini's later and more limited work, his reconstruction of the Palace of the Caesars. He was not content with mere erudition, the exact description of painstaking excavations on the Palatine performed under his general direction as supervisor of ancient Latin inscriptions found in Rome. He arranged the archeological details according to a philosophy or principle inferred from Vitruvius, that all the important buildings of late antiquity were strictly symmetrical. Putting philosophy and erudition together, Bianchini designed for the caesars an extensive baroque palace surprisingly similar to Versailles.[45]

The exercise of *buon gusto* evidently does not always result in enduring truth. But that, as Muratori said, is as it should be. The only certainty is in revealed truth, the truth of Christ and his apostles, and the unerring decisions about matters relating to faith and morals made by the popes and general councils. Science does not reveal such truths; but then, neither does it touch faith. Christ did not undertake to teach the human race astronomy or physics or history; what we know about them is always amendable; *buon gusto* allows us to balance the relevant evidence, weigh alternatives, and select the more probable, the better, or the best opinion in accordance with our developing knowledge.[46] Here we act as masons (muratori!), checking and correcting foundations before building further, that is, identifying our prejudices and discarding the poorly founded beliefs of ancient, and as it sometimes happens, also modern authorities. Nothing can be in poorer taste than slavishly following a master, or in better taste than judiciously copying the Cartesians, who doubt everything before they build.[47]

Yes, the church has proscribed the works of Descartes, but that is no reason, advises Muratori, to despise them all. Their blanket condemnation testifies more to the zeal, ignorance, and prejudice of the censors than to the value of Descartes' philosophy.[48] Similarly, the Inquisition condemned the theory of Copernicus. That

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[42] *Buon gusto* (1708, 1715), henceforth BG, I.4 (228-9), II.2 (256-9), page references to the partial reprinting in Muratori, *Opere* (1964).
[43] The group in Rome that pushed *Agnello* through the censorship referred jokingly to Bacchini's master as "l'eretico Mabillon." Carraciolo, *Passionei* (1968), 51.
[44] BG, II.3 (260-3), II.5 (267).
[45] Engleberg, in Kockel and Sölch, *Bianchini* (2005), 155-6, 160.
[46] BG, I.6 (236, 238, 241). Cf. *De ingeniorum moderazione* (1714), hereafter IM, I.10 (297), I.16 (301).
[47] BG, II.4 (266), I.5 (231-3), I.7 (242-3).
[48] IM, II.13 (321).

was unwise and impertinent. It is irrelevant to faith whether the earth goes around the sun or the sun the earth; the theologians erred by relying on the judgment of men who had been instructed not by Christ but by Aristotle. The proper method would have been to weigh the evidence and suspend judgment "until we are convinced by reasons."[49] Zealous and ignorant inquisitors made a travesty of the wholesome decree of the Council of Trent that prohibits twisting Scripture to support an interpretation of passages concerning faith and morals contrary to the sense taught by the church or the consensus of the fathers. It is truly twisting this decree, says Muratori in a brilliant interpretation of the interpreters, to apply it to the sciences, historical, philosophical, physical, astronomical, or geographical. Rather, the decree protects a wide freedom of inquiry into these and similar subjects. It warns against the "exuberant zeal of certain people" who would apply improperly the thought and authority of the fathers to indifferent or useless questions "while expounding places in Scripture having nothing to do with the faith, morals, and structure of Christian doctrine."[50] The Holy Books are hard to know and can be understood in many different ways not obnoxious to faith. All such opinions are allowed.[51] You are more likely to be wrong than right. "Ad eruendam veritatem, Humilitas, Humilitas, Humilitas!"[52]

Muratori conceded the value of the censorship in suppressing craziness, impiety, and false doctrine. Problems arise because some consultors and inquisitors do not possess that cardinal ingredient of good taste, "la santa moderazione." "Letterati do not fear learned and wise censors, but ignorant and imprudent ones."[53] Killing good books, or, what amounted to the same thing, inculcating a deadly self-censorship, deprived Catholics of important information and gave Protestants many occasions for laughter. Muratori spoke from experience. He had felt the chains of self-censorship ("my pen contains many observations that may not be useless, which would have liked the license to escape, but are constrained to stay home") and when incautious sometimes raised the eyebrows of the Inquisition. At the time of the Bacchini affair he complained to a friend that if matters did not improve, "the poor letterati will print only the paternoster."[54] The only near-term hope was education, enlightenment, a breed of censors who did not suppose that in disputed non-dogmatic matters their opinion, often based on irrelevant Scripture, would emerge as correct. "Who therefore does not see that erudition and science are necessary lest truth be injured or suffocated, and superstition run riot?"[55]

Good taste and good science

Bianchini accepted separation of the spheres of faith and science, and the free exercise of the intuition and reason in scientific matters. He believed in and practiced weighing the evidence before accepting an alleged historical or physical fact, and withholding judgment where the evidence did not determine the balance of probabilities. Furthermore, in applying these propositions to the new science of his time, he found, as did Muratori, that Galileo, Descartes, and Mabillon had opened the

[49] BG, I.6 (236-7, quote); IM, I.21 (307).
[50] IM, I.23 (311, 313 quote).
[51] IM, I.5 (22 (309).
[52] Muratori, BG, quoted in Marchi, in Romagnani, *Scipione Maffei* (1996), 367.
[53] BG, II.1 (255-6).
[54] BG, II.9 (277-8), II.1 (255, first quote), II.9 (277n, second quote).
[55] IM, II.13 (319, II. 14 (323, quote).

most promising avenues for advance in astronomy, physics, and history irrespective of the opinions of the Inquisition. But whereas Muratori advertised vexed questions, Bianchini kept his own counsel so effectively that the censor of his book on Venus saw nothing to object to in it. On the contrary, he pretended that the "most erudite" Bianchini had so presented the facts that "no one could seek arguments from them in support of [either] of the two most widely held systems of the world." And yet Bianchini's preference was as obvious as Galileo's, whose flimsy claim to have treated Copernicus and Ptolemy equally did not fool the censors of his day. A century had elapsed between the condemnation of Galileo's book and the approval of Bianchini's. Nonetheless, although he praised Galileo fulsomely ("the prince of all…who increased our knowledge of mathematics and physics with so many new discoveries"), Bianchini could not free himself from the self-censorship that the letterati of his generation had internalized.[56]

Muratori's distinction of the spheres of faith and science turns on an apparently parallel separation of powers: organized religion decides dogma and science investigates everything else. In practice, however, this narrow line was (and is!) a wide border. No complete catalogue of dogmas existed. Was geocentrism ever dogma? The sloppy character of the trial, sentencing, and recantation of Galileo embroiled the question. Some people held that between them Popes Paul V and Urban VIII declared heliocentrism a heresy. Others thought that the action against Galileo was just that, a personal affair that had no wider juridical applications.[57] Where should the censor with *buon gusto* stand? Would it not be prudent of him to warn the faithful against accepting views that in his expert judgment might some day be made contrary to dogma? Where did the burden of proof lie? Muratori gave the benefit of all doubt to science. Bianchini may have agreed, but with the reservation, unacceptable to Muratori, that ntelligent informed censors had the obligation to correct or reject garbage masquerading as knowledge. After all, as Muratori often remarked, the world is full of scribblers who lie, exaggerate, take paste for gems, overrate the ancients or the moderns, blindly follow some master, and, withal, are vain presumptuous, and stupid. "Letterati of perfect taste hate these imposters."[58] Should the censors try to stop them? Should university presses?

Bianchini's harmonizing of faith and science came at the cost of self-censorship. His publications in science, though bold and occasionally even reckless, left wide highways of retreat. Thus, as astronomer, he maintained access to the safe grounds of mathematics and hypothesis; as archeologist, to the safeguards of material objects; as historian, to confirmation of the natural and historical accounts of the Old Testament through pagan sources. These moves or the need for them may not have made our sunny monsignore uncomfortable. But they may account for his leaving so much of his work unfinished, from universal history to the study of minute variations in the apparent orbits of the stars. These last observations opened the way, which Bianchini did not follow, to one of the greatest discoveries in physics and astronomy, the aberration of starlight.[59]

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[56] Bianchini, *Hesperi* (1996), 14, 22.
[57] Heilbron, in McMullin, *Church* (2005), 281-4.
[58] BG, I.9-10 (250, 251 quote); II.12 (284).
[59] Manfredi, in Bianchini, *Astronomiae* (1737), 265-6.

The frontispiece to Bianchini's book on Venus makes a perfect symbol for the strengths and weaknesses of his good taste in science. An angel at top center trumpets something new. A Minerva sits on a pedestal under the trumpeter. She points with one hand toward a landscape where Bianchini directed his digs and raised his telescopes, and holds in the other a portrait of King John V of Portugal, who paid for the printing of the book. On the left side of the pedestal an Atlas staggers under the weight of the Farnese globe and a putto kneels to present a small simulacrum of Venus with the spurious surface markings that Bianchini had discovered. (His book on Venus was as clever and as wrong as the *Istoria universale* and the reconstruction of Caesars' Palace.) On the right side stands an attractive assistant in ancient garb. At her feet are mathematical instruments, geometrical drawings, and arithmetical calculations. With her right hand she offers the king an armillary of the Venusian system with an unoccupied center. She is too coy to insert into the center the body, sun or earth, which would reveal the world system she favors. Like Bianchini, she would rather live quietly and perhaps a little superficially than grub to the bottom of natural science and human history.

It may be that people like Bianchini, who manage to construct a working whole of their faith, science, and religion, buy their tranquility at the price of seldom making an enduring contribution to any of them. Those living in partial harmony, like Muratori, waste time worrying. The censors required changes in his work, and he always made them, though sometimes reluctantly. That should have been enough. But as he neared his end, he worried that not even death would free him from the censorship. Some future blinkered guardians of orthodoxy, giving way to the Jesuits who had been hunting him for years, might find fault with his doctrine. The thought depressed him so much that he came to fear the Scripture that defined his faith and their dogma.[60] Constant concern about stepping over a vague and arbitrary line had sapped his strength and, if we are to credit his words, turned his love of the bible into worry and suspicion.

That leaves Montanari, who did make enduring contributions to science, for example, observations of comets that Newton used to demonstrate their recurrence and the discovery of variable stars. He knew his mind and expressed it strongly. He promoted the new mechanical philosophy openly and effectively, and inspired several disciples who rose to influential positions in the church. Although he too felt constrained by the machinery of his religion, he was not constantly looking over his shoulder, at least not after his move to Padua. There he had enough freedom to indulge a touch of Einsteinkrankheit, the unswerving commitment to a research program despite apparently cogent objections from established authorities and compliant colleagues. A hundredth of a unit of Einstein sickness might make a savant sufficiently uncomfortable to be a discoverer – provided officious gatekeepers do not cure him of it first.

[60] Letter to Scipione Maffei of 20 Jan 1750, quoted by Marchi, in Romagnani, *Scipione Maffei* (1998), 371.