

## Galileo and Scientific Epistolography in the Late Renaissance

Galileo was one of the most prolific correspondents of his age: well over four thousand letters, by, to and about him survive and comprise volumes 10 to 18 of the National Edition of his *Works*, edited by Antonio Favaro and published from 1890 to 1909. Letters from other sources unknown to Favaro, emerge occasionally and are published and translated but Galileo letters are decidedly rare in the marketplace: there are only five holographs recorded in North America (two in the Historical Society of Pennsylvania, one at the University of Michigan, one in the Smithsonian and one (perhaps) at Toronto). The substance and form of Galileo's letters range from short, personal notes to extended treatises on scientific subjects. The purely personal ones retain a revealing charm and polished style which helps form our image of Galileo's character, for instance, one of the Philadelphia letters is concerned entirely with wine which was sent to him in 1636, possibly by the Holy Roman Emperor. In fact, more of Galileo's surviving letters relate to wine than to copernicanism. The longer discussions of scientific and philosophical matters are crucial to any understanding of his accomplishments and must be read together with his books and pamphlets which were published in the normal manner.

'Epistolography,' which in English may be defined literally as 'letter writing,' has, through usage, developed a distinct meaning (apart from its specialized use to denote a particular form of ancient Egyptian writing) and thus the difference between a letter and an epistle may be likened to the difference between a private conversation and a Platonic dialogue. A letter is private, personal, ephemeral and non-literary; an epistle is a literary form, written with an audience in mind and has some pretense to permanence. Obviously these distinctions are not categorical but are important with reference to the correspondence of scientists during the 16th and 17th centuries.

Epistles were used, in lieu of printed books and pamphlets, to communicate information to a select audience for limited dissemination; if the information was especially sensitive, or merely tentative, the level of control was important to the writer. Conversely, it could be argued that for certain kinds of technical information the audience was so small that an epistle that could be copied and passed on was all that was required; a pamphlet would not have paid for the cost of printing it. The letter that Galileo sent to Claude de Peirenc on May 12th 1635 concerning a magnetic clock was immediately sent on to another interested party; a copy was supposed to have been made for Pieresc's files but did not survive and the original wandered in a sort of intellectual limbo until it was published in 1967. The obvious danger of circulating opinions in manuscripts was that each time an epistle was copied it could be altered, either inadvertent or deliberately and a deliberate excision in one of Galileo's had serious consequences.

From the great mass of epistles and letters written by Galileo one connected of 1613 to 1615 series holds particular interest as it culminated in his classic discussion regarding the relationship between the new science and the teachings of the Catholic Church: the so-called *Letter to the Grand Duchess Christina*. All of these documents have been published and translated into English, most recently by Maurice A. Finocchiaro in his *The Galileo Affair* (1989). They provide an extended and coherent example of the use of epistolography (and incidentally, letter-writing) by Galileo and some of his colleagues and opponents.

On December 14th, 1613 Benedetto Castelli, a Benedictine monk, former student and collaborator of Galileo, and, at this date, professor of mathematics at Pisa, wrote to Galileo: "Very Illustrious and Most Excellent Sir: / Thursday morning I had breakfast with our Lordships, and, when asked about school by the Grand Duke I gave him a detailed account" (the Grand Duke was Cosimo de Medici II, the ruler of Tuscany). Castelli then discussed the Medicean planets and his telescope and Galileo's name was thus drawn into the conversation. As Castelli was leaving he was called back at the request of the Grand Duchess, Christina of Lorraine, the mother of Cosimo II, for further discussion. She had been explicitly told by Prof. Boscaglia, a philosopher of Pisa, that despite the truths of what he referred to as

Galileo's 'celestial novelties,' the earth could not move since it was clearly contrary to Holy Scripture. Castelli then found himself being questioned closely by the formidable Grand Duchess in the company of her relatives and advisors. He was aware of the delicacy with which any views that could be construed as Copernican had to be presented and also aware of the anti-Galilean factions at both Florence and Pisa. According to his account Castelli acquitted himself nobly, for, as he expressed it, he "began to play the theologian with such finesse and authority that you would have been especially pleased to hear." He ends by saying that Niccolo Arrighetti (a friend of Galileo) will fill in all the details of this optimistic meeting; but this letter / more a letter than an epistle: Favaro records only one copy) clearly contains a warning about the nature of the questions being asked and their implications for Galileo.

Galileo responded quickly (on December 21st)<sup>1</sup> with a long letter on the impropriety of mixing science and religion; but also refuting Biblical objections to the motion of the earth with special reference to the miracle of Joshua, a Biblical passage cited by the Grand Duchess in her conversation with Castelli. This epistle was copied and widely circulated: (Favaro records 13 manuscripts), known as the "Letter to Castelli" and forms the basis of the "Letter to Christina." Galileo begins with several compliments to Castelli: "what greater fortune can you wish than to see their Highnesses themselves enjoying discussing with you, putting forth doubts, listening to your solutions, and finally remaining satisfied with your answers?" He then tackles the Scriptural questions: "In regard to the first general point of the Most Serene Ladyship, it seems to me very prudent of her to propose and of you to concede and to agree that the Holy Scripture can never lie or err, and that its declarations are absolutely and inviolably true. I should here added only that, though the Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways." This is the nub of Galileo's argument; natural phenomena can be reconciled with scriptural teaching or, as he put it: "the task of wise interpreters is to strive to find the true meanings of scriptural passages agreeing with those physical conclusions of which we are already certain and sure from clear sensory experience or from necessary demonstrations." He then takes up the problem of Joshua, chapter 10 verses 12-13, where the Sun stood still so

that the Israelites could defeat the Amorites, a question to Castelli by the Grand Duchess as reported by Arrighetti. Galileo's ingenious argument is that, for anyone who understands astronomy, stopping the sun according to the system of Ptolemy and Aristotle would actually shorten the day, not lengthen it, while "if in conformity with Copernicus's position the diurnal motion is attributed to the earth, anyone can see that it sufficed stopping the sun to stop the whole system, and thus to lengthen the period of the diurnal illumination without altering in any way the rest of the mutual relationships of the planets; and that is exactly how the words of the sacred text sound." This explanation no doubt satisfied Castelli and he no doubt repeated all the arguments; it would take a good deal more to satisfy the Aristotelian philosophers and the theologians.

No further correspondence is documented for about a year, but then the Dominicans swung into action. In December 1614 Tommaso Caccini preached a sermon in Florence against mathematicians and Galileo in particular and on February 7th 1615 Niccolo Lomini, another Dominican, filed an official complaint against Galileo with the Inquisition in Rome saying that "there is a limitless obligation that binds all Dominican friars, since they were designated by the Holy Father the black and white hounds of the Holy Office"<sup>2</sup> (hence *Domines Canes*). He enclosed a "faithful copy" of the "Letter to Castelli"; how faithful it was can still be seen as it survives in the Vatican Archives. It was, of course, considerably altered: for example the phrase "somewhat concealing" is changed to the word "perverting" and it began the paper trail of evidence that ended with the trial of Galileo in 1633. Only nine days later, on February 16th 1615, Galileo wrote to Monsignor Piero Dini, a Florentine intellectual who, at this time, held a minor Vatican appointment and was living in Rome.<sup>3</sup> Galileo had heard of the attacks from the pulpit and that Lomini had a copy of the letter to Castelli. He suspected that the copy had been altered and thus enclosed a true copy to be shown to Father Grienberger, a Jesuit Professor of mathematics, suggesting that it might also be read by Cardinal Bellarmine, the most influential churchman of his time and a consultant to the Inquisition. Galileo cautions against reading his letter to Castelli literally, as it had been written "with a quick pen," but said that he is working on a very long essay which had not yet been "polished." This reference is to

the *Letter to Christina*. He then goes on to defend Copernicus as a Catholic and a clergyman whose book was dedicated to the Pope of the day and states again "that the author of this doctrine is not a living Florentine but a dead German" (Copernicus was actually Polish). Dini apparently did have both letters copied as at least five copies of the letter to him survive.

In his reply of March 7th 1615 Dini<sup>4</sup> reports that he has made the copies and has had them distributed; even to "the Most Illustrious Bellarmine, with whom I spoke at length about the things you mention." Bellarmine apparently assured Dini that he had heard nothing against Galileo and did not see any real problems with Copernicus's book. He was probably dissembling and did warn Dini that one ought "not to jump hurriedly into condemning anyone of these opinions." Dini's letter is recorded by Favaro only from the original autograph.

On March 23rd Galileo wrote again to Dini<sup>5</sup> a long letter that is really an epistle and of which at least nine copies survive. He says that he will reply only briefly because of his poor health but the letter, in fact, is quite long. He considers in detail the suggestion (made by Bellarmine) that the way around the doctrinal difficulties of Copernicus's book was to add a commentary indicating that Copernicus wrote "to save the appearances." This phrase seems to have meant the explanation of observed natural phenomena by means of assumptions made for the convenience of calculation but not believed to be true; analogous to the use by others of eccentrics and epicycles for calculation. Galileo was having none of this: "to claim that Copernicus did not consider the earth's motion to be true could be accepted perhaps only by those who have not read him." His arguments continue, clearly and concisely stating what now seems obvious, and this real purpose, in this context, emerges: "I am in the process of collecting all of Copernicus's reasons and making them clearly intelligible to many people, for in his works they are very difficult; and I am adding to them many more considerations, always based on celestial observations, on sensory experiences, and on the support of physical effects. Then I would offer them at the feet of the Supreme Pastor for the infallible decision by the Holy Church, to be used as their supreme prudence sees fit." The references are to Galileo's essay "Considerations the Copernican Opinion" (also 1615) to the "Letter to Christina" and, perhaps, to the beginnings of the

*Dialogue* of 1632. The warning is clear: the Church will find itself in an untenable and embarrassing position if it confirms its official belief in a system of the universe that can be demonstrated to be false: and so it proved today Galileo is considered by some to have been a better theologian than the theologians. Bellarmine had also mentioned Psalm 18 (19 in the King James version), the comparison of the sun to a bridegroom coming out of his chamber, as an explicit reference to the motion of the sun. Galileo counters with scriptural interpretation, specifically his reading of Psalm 73:16: "Thine is the day, and thine is the night: thou hast made the morning light and the sun" and Psalm 18:6: "God hath set his tabernacle in the sun."<sup>6</sup> Thus the bridegroom becomes the light, which moves, not the sun, which is the bride-chamber, the great receptacle, the most noble seat of the sensible world. To mitigate his "excessive audacity" in attempting to comment on Holy Writ he then quotes Psalm 18:8: "the testimony of the Lord is faithful, giving wisdom to little ones" (many can play the game of scriptural quotation) but concludes this epistle, obviously meant for eyes other than Dini's, with the warning "I beg you not to let it come into the hands of any person who would use the hard and sharp tooth of a beast rather than the delicate tongue of a mother, and so would completely mangle and tear it to pieces instead of polishing it." Sharp teeth were waiting.

Galileo's attitude towards his philosophical and theological opponents remained sanguine, especially as support for his position came from an unexpected source. In late February or early March 1615 Paolo Foscaridi, a Carmelite Provincial and Professor of Theology from Messina published a book called "Letter on the Pythagorean and Copernican Opinion of the Earth's Motion and the Sun's Rest and on the New Rythagorean World System, in which are Harmonized and Reconciled those Passages of the Holy Scripture and those Theological Propositions which could ever be Addued against this Opinion."<sup>7</sup> The title says it all and it seems to have influenced Galileo, against the advice of his friends, to prosecute his case more forcefully. Bellarmine was also sent a copy of Foscanini's pamphlet and wrote to him on April 12th: "Your Paternity and Mr. Galileo are proceeding prudently by limiting yourselves to speaking suppositionally and not absolutely, as I have always believed that Copernicus spoke." He also invokes Solomon ("the sun also riseth and the sun goeth

down”) as a man “above all others wise and learned in the human sciences.” Foscarini died in 1616 and his “Letter” proved to be of no help to Galileo when the Inquisition consultants came to consider the question of heresy.

Also in 1615 Galileo wrote and circulated an essay called “Considerations on the Copernican Opinion” which attempted to answer the epistemological and philosophical objections to Copernicus. None of the several extant manuscripts contains an explicit indication of authorship or a date but internal evidence and references to letters give conclusive confirmation of both. He proceeds to argue negatively against what he calls the “two ideas” commonly held by his opponents. The first is “that no one has any reason to fear that the outcome might be scandalous, for the earth’s stability and the sun’s motion are so well demonstrated in philosophy . . .” and the second that “although the contrary assumption has been used by Copernicus and other astronomers, they did this in a suppositional manner . . .” His demonstrations of the fallaciousness of these positions will be “suitable to be understood without much effort and labour even by someone who is not well versed in the natural and astronomical sciences.” The many pages which follow elucidate and expand the familiar arguments. Ancient and modern writers are cited, from Pythagoras and Plato to William Gilbert and Kepler, to demonstrate that although most people accept the interpretations of the theologians and peripatetic philosophers the minority opinions are significant and can be proven without compromising received doctrine. “The motion of the earth and the stability of the sun could never be against Faith or Holy Scripture, if this proposition were correctly proved to be physically true by philosophers, astronomers and mathematicians, with the help of some experiences, accurate observations, and necessary demonstrations. However, in this case, if some passages of scripture were to sound contrary we would have to say that this is due to the weakness of our mind, which is unable to grasp the true meaning of scripture in this particular case: “He concludes with a point-by-point reply to Bellarmine’s opinion (indicating that he had a copy of it) perhaps intended for use by Foscarini.

Galileo’s “Letter to the Grand Duchess Christina,” an epistle of some 40 pages, was completed by mid 1615. It is an expansion and elaboration of the “Letter to Castelli” of 1613 which had dealt

specifically with questions raised by Christina in conversation. In this form it became Galileo's full, considered opinion on the relationship between religion and science or, as one sub-title puts it: "concerning the use of Biblical quotations in matters of science."<sup>14</sup> It was widely circulated (Favaro located 34 copies) but was not published until 1636, and then in Protestant Strassburg in a parallel Latin/Italian edition without, of course, authorization. It first appeared in English in 1661, translated by Thomas Salusbury with the explicit and appealing title: "The Ancient and Modern Doctrine of Holy Fathers, and Judicious Divines, concerning the Rash Citation of the Testimony of Sacred Scripture, in Conclusions meerly Natural, and that may be Proved by Sensible Experiments, and Necessary Demonstrations." "As Your Most Serene Highness knows very well" Galileo begins, "a few years ago I discovered in the heavens many particulars which had been invisible until our time. Because of their novelty, and because of some consequences deriving from them which contradict certain physical propositions commonly accepted in philosophical schools, they roused against me no small number of such professors, as if I had placed these things in heaven with my hands in order to confound nature and the sciences." He then recapitulates and expands all the points and issues raised in the previous two years' correspondence, considered from a general, philosophical view. His intention is clearly stated: "For my purpose is nothing but the following: if these reflections, which are far from my own profession, should contain (besides errors) anything that may lead someone to advance a useful caution for the Holy Church in her deliberations about the Copernican system, then let it be accepted with whatever profit superiors will deem appropriate; if not, let my essay be torn up and burned . . ." The "Letter to Christina" is a sustained and convincing, if somewhat repetitious, performance, but although it may have convinced Christina and Galileo's supporters it did not convince the Holy officials as the central proposition of Copernican theory was declared heretical.

The several manuscripts of the "Letter to Christina" differ somewhat textually, which is not surprising considering the different kinds of audiences they were copied for. As an illustration, this contemporary copy (not in Galileo's hand) from the Stillman Drake Galileo Collection in the Thomas Fisher Rare Book Library,<sup>15</sup> contains on



its first page the phrase "si e fatto palesare," which does not appear in the standard text as printed by Favaro. It is, however, in the Italian portion of the 1636 edition, although the conjectural reading "palesare" is given as "palese." No attempt, as far as I know, has been made to produce a scholarly, conflated version of the different manuscripts.

In December 1615 Galileo went to Rome personally to attempt to clear his own name and to prevent the official condemnation of Copernicanism. Essentially he urged that no official church action be taken. His failure to achieve this objective is revealed through the Inquisition's documents. An assessor (or consultant) who looked at the "Letter to Castelli" concluded that although some of the words and phrases "sounded bad" (he saw a corrupted copy of the letter) it did not "diverge from the pathways of Catholic expression."<sup>16</sup> Two witnesses who testified were dismissed because of heresy evidence. However, on February 24th 1616 a committee of eleven consultants reported that Copernicanism was philosophically and scientifically untenable and theologically heretical. Even then there was no formal condemnation; instead Galileo was privately warned by Cardinal Bellarmine to stop defending Copernicus and not to teach geokinetic theories. The exact nature of the warning is complex and confused and it became the central controversy of the 1633 trial. The Congregation of the Index also suspended circulation of *De Revolutionibus*, pending correction and revision. Thus Galileo left Rome neither tried nor condemned: that was left for the future.

This series of seven connected documents, all of them letters or epistles (or combinations thereof) and, with the exception of the "Letter to Christina," none of them published until the late 19th century, illustrate something of how the epistolary form was used by Galileo and his contemporaries to communicate quickly and efficiently. The epistolography of Galileo, both the letters he sent and the letters he received, constitute a significant part of the corpus of his work.

Another letter of Galileo, also from the Stillman Drake Collection, was mentioned earlier, in a slightly enigmatic way, and it presents different problems. The text covers five pages, in Italian, and concerns astronomical matters, specifically the Tyconic system and Kepler's elliptics, and mentions the Copernicus. The letter is undated and unsigned but internal evidence indicates, with reasonable cer-

tainty, that it was written by Galilee. It is, in fact, possible to establish its date as March or April 1633, when Galilee was living in the Tuscan embassy in Rome awaiting his trial by the Inquisition, as the watermarks on the two sheets of paper (a duck on three mounds with the initial "D") correspond to four dated letters of this period. The letter is inscribed, on its final black page, in a different hand "P. re Abbate Lanci." This letter has been twice published; in 1966 as "possibly by Galilee"<sup>17</sup> and again in 1986 as "a neglected Galilean letter."<sup>18</sup> Its odd form is explained in the commentary to the second publication. The letter begins "Most Illustrious Sir: The question which you propose to me for another is curious." The addressee is Raffaello Magalotti, a Florentine friend of Galileo living in Rome, who proposed the question on behalf of Giovanni Maria Lanci, the Procurator General of the Oratorio order. Galileo was awaiting trial, so any signed and dated letter mentioning Copernicus that might be copied by his enemies would have been very dangerous. His opinion, however, could easily be conveyed anonymously and, indeed, no other copy of this letter is known. The hand is conjectured to be Galileo's, which also fits in with the circumstances, and thus another important Galilean text has been added to the canon. There are, no doubt, more to be discovered, published and translated; and argued over and interpreted by historians and philosophers of science. It is likely that they will appear in an "epistolographical" form.

*University of Toronto: Thomas Fisher Rare Book Library*

## NOTES

- 1 This paper is based on Maurice A. Finocchiaro's *The Galileo Affair: A Documentary History* (Berkeley, University of California Press, 1989), Stillman Drake's *Galileo At Work: His Scientific Biography* (Chicago, University of Chicago Press, 1978), Stillman Drake's *Discoveries and Opinions of Galileo* (Garden City, Anchor Books, 1957) and other papers cited in subsequent notes.
- 2 Translated and published by Stillman Drake in *Isis*, vol. 53, p. 210-211, 1962 (Galileo Gleanings No. XII). Republished with full notes and a facsimile in *A Letter From Galileo*, by Bern Dibner and Stillman Drake. Norwalk, Burndy Library, 1967. The original is now in the Smithsonian Institution.
- 3 Finocchiaro p. 47-8.
- 4 Finocchiaro p. 49-54.

- 5 Finocchiaro p. 134.
- 6 Finocchiaro p. 55–8.
- 7 Finocchiaro p. 58–9.
- 8 Finocchiaro p. 60–7.
- 9 All Biblical quotations are from the King James Version.
- 10 Published in Italian in Naples in 1615, it was translated into English by Thomas Salusbury and published in his *Mathematical Collections and Translations* (London, 1661–1665)
- 11 Finocchiaro p. 67–9.
- 12 Finocchiaro p. 70–86. This essay was accepted as Galileo's by Antonio Favaro and published by him in *Le Opere di Galileo Galilei*. 20 volumes (Florence, 1890–1909) cf. vol. 5, p. 277.
- 13 Finocchiaro p. 87–118. Also translated by Stillman Drake in his *Discoveries and Opinions of Galileo*, p. 173–216.
- 14 Drake *Discoveries* p. 173.
- 15 Galileo Collection, MS. no. 10.
- 16 Finocchiaro p. 136
- 17 S. Drake "An Unpublished Letter, Possibly by Galileo," *Physis*, vii (1966), p. 247–52
- 18 S. Drake. "A Neglected Galilean Letter," *Journal for the History of Astronomy*, xvii (1986) p. 99–108