The Galileo Affair

Ernan McMullin

Summary

The Galileo Affair long ago became the stuff of legend, defining for many a necessarily tense relationship between science and religion. It has been (and still is) the subject of charge and counter-charge. It may help, then, to outline (insofar as it is still possible) what happened in those tumultuous years. How and why did the Church become involved? And what of the famous trial?

In February 1616, the Roman Congregation in charge of the Index of Prohibited Books, acting under the authority of Pope Paul V, banned the work of Nicholas Copernicus, *On the Revolutions of the Celestial Spheres* (1543), on the grounds that its claim that the earth revolved around the sun was 'contrary to Scripture'. The best-known defender of the suspect doctrine, Galileo Galilei, was officially warned to abandon it. Seventeen years later, subsequent to the publication of his *Dialogue on Two Chief World Systems,* Galileo was condemned by the Roman Inquisition (more formally: the Holy Office) on 'vehement suspicion of heresy' for 'holding and believing' a doctrine that had been 'declared and defined' to be contrary to Scripture. These two episodes constitute, in outline, the celebrated 'Galileo Affair'.

Part One: The condemnation of the sun-centred world-view, 1616

1. Preparing the way

To understand what happened in 1616, we need to go back almost a century earlier. One consequence of the reformers' emphasis on *sola Scriptura* (Scripture alone) as the rule of faith was, among Protestant and Catholic theologians alike, a more literalist approach to the interpretation of biblical texts. Among Catholic theologians more particularly, this was accentuated by the decrees of the Council of Trent emphasising 'unanimous agreement of the Fathers' as a sure guide to the 'true sense' of Scripture. A striking example: In his teaching of cosmology at the University of Louvain in 1570-72, the Jesuit theologian, Robert Bellarmine, who would later play a major role in the events of 1616, looked to the Bible, literally understood, for support of his astronomical views rather more than to the traditional source, Aristotle.[1]

The 'physical' astronomy of Aristotle, with its carrier spheres, had always seemed to explain the planetary motions better than the 'mathematical' astronomy of Ptolemy, with its epicycles (circles on circles), leaving the latter to be widely regarded as no more than a better predictive device. Copernicus's work seemed clearly to belong to the mathematical tradition of Ptolemy, though its author insisted that it gave reason to believe in the reality of the earth's motion around the sun. His argument was not helped by the well-meaning but unauthorised insertion of a preface by a Lutheran theologian, Andreas Osiander, assuring the reader that the book should be understood in the traditional 'mathematical' way as an aid to calculation only.

About the Author

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For several decades the work drew little attention among philosophers and theologians, no doubt in part because of Osiander's preface. But in 1570, Christoph Clavius, the leading Jesuit astronomer of the day, criticised Copernicus's realist claims on traditional physical grounds, pointing also to a number of passages in the Bible where the motion of the sun or the stability of the earth was expressly mentioned.[2] Between 1600 and 1610, several prominent Jesuit Scripture scholars followed him in citing the Bible against Copernicus, one of whom, Nicholas Serarius, even accused the Copernican view of heresy for calling Scripture into question. So even before Galileo entered the debate, the Copernican view was already under theological attack.

2. Galileo's telescopic discoveries

Galileo's career took an entirely new turn in the autumn of 1609 when he pointed his newly perfected telescope to the skies. Until then, as a professor of mathematics and natural philosophy at the University of Padua, he had devoted most of his attention to mechanics and had already made what would later prove to be major discoveries. But now he set mechanics aside and turned to astronomy. In rapid succession, he discovered what appeared to be mountains and other terrestrial features on the moon, spots on the sun (itself apparently rotating), four 'moons' circling Jupiter, and periodic phases in the illumination of Venus like those of our own moon. Taken together, they definitively undermined Aristotle's cosmology. Gone were some of its crucial features: the sharp distinction between the earth and the heavenly bodies, the earth as the unique centre of circular motions, the unchanging character of the heavenly bodies. Above all, the phases of Venus showed that it did not circle the earth.

The impact of Galileo's best-selling *Sidereus Nuncius* (1610) all

1 Baldini, U. and Coyne, G.V. (eds.and trans.) *The Louvain Lectures of Bellarmine,* Vatican City: Vatican Observatory Publications (1984).

2 See Lerner, M.-P., 'The heliocentric 'heresy'', in McMullin, E. (ed.) *The Church and Galileo,* Notre Dame IN: University of Notre Dame Press (2005), 11-37 (pp.18-19).

across Europe was dramatic.[3] Aristotle's cosmology had, for centuries, been standard fare in all the universities; it would take time to absorb this sudden reverse. Galileo was emboldened, however, to go one step further and to present his discoveries as validating the Copernican heliocentric world-system. This allowed his Aristotelian critics in Florence the opportunity to strike back: Aristotle's physics of motion still held good and it claimed to prove the immobility of the earth. More significantly, they could in addition invoke an already familiar theological argument: the Copernican theses were incompatible with Scripture. His Benedictine friend, Benedetto Castelli, reported a discussion at the table of Galileo's Medici patron, Cosimo II, where the dowager Duchess Christina seemed impressed by the theological case against the Copernican view.

3. Galileo's theological venture

Troubled, Galileo wrote a long letter to Castelli, formulating a number of principles that should defuse apparent conflict between Scripture and natural knowledge.[4] First, the biblical writers clearly accommodated their language to the 'capacity of ordinary people'. They would be particularly likely to do so when describing nature. Second, Scripture ordinarily lends itself to multiple interpretations. Thus, if a literal reading of Scripture conflicts with 'sensory experience or necessary demonstration', the latter should be given priority. Third, Scripture encompasses only those doctrines that bear on salvation and surpass human reason, hence not those that could be arrived at through ordinary human means. Fourth, the God who has given us 'senses, language, and intellect' would hardly want to bypass their use, particularly in the case of astronomical matters which are hardly ever mentioned in the Bible. Fifth, prudence should dictate that one should never commit irrevocably to an interpretation of Scripture in regard to nature where the contrary could conceivably be proved later 'by the senses or demonstration'.

These might seem to be no more than common sense. The first, in particular, was a traditional principle in medieval theology and had an obvious application to the ways in which the sun's motion and the earth's stability are customarily described. But at a time when literalism reigned, they (and most especially the third) could well appear suspect. Galileo decided to write a more fully-argued version of his case, this time (with the help of others) citing theological authorities in great detail, calling in particular on Augustine's influential commentary on *Genesis*. The resultant *Letter to the Grand Duchess Christina* is now recognised as a theological classic.[5] But he evidently decided not to circulate it widely, probably advised by his Roman friends who would have seen that a treatise on a highly controversial theological topic by a mere 'mathematician' would be likely to antagonise further the already suspicious Roman authorities.

In the meantime, however, a copy of Galileo's letter to Castelli had been forwarded to the Congregation of the Index by one of Galileo's Dominican critics. And perhaps even more seriously from the Roman standpoint, a respected Carmelite theologian, Paolo Foscarini, had published a short work defending the 'clearly probable' Copernican system from theological attack, citing many of the same arguments that Galileo had used. Galileo's visit to Rome in late 1615 to make his case in person, in the process challenging his critics directly, might have been the last straw,[6] though the Foscarini publication could have been enough on its own to bring about a Roman reaction.

4. The Copernican theses are judged to be contrary to Scripture

In February 1616, the Holy Office appointed a committee of consultors to advise on the orthodoxy of the two Copernican assertions: the immobility of the sun and the motion of the earth.[7] They judged the first to be 'foolish and absurd in [natural] philosophy and formally heretical since it explicitly contradicts … the sense of Holy Scripture'; the second received the same assessment in natural philosophy but a slightly less negative one ('erroneous in faith') in theology.[8] The subsequent official decree of the Index (March 5, 1616) was more guarded. It declared that the Copernican theses were 'false and altogether opposed to Holy Scripture' but made no mention of heresy. Copernicus's book was to be 'suspended until corrected'.

Galileo was not mentioned in the decree but the Pope (Paul V) instructed Cardinal Bellarmine to call in Galileo privately and order him to abandon the condemned doctrine. If he should refuse, a formal injunction should be given him by the Commissary of the Holy Office, Michelangelo Segizzi, 'to abstain completely from teaching or defending' it or even from 'discussing' it. Bellarmine reported back to the Holy Office that Galileo had 'acquiesced' when warned to abandon the Copernican doctrine. And at Galileo's request, he later gave him a certificate stating that he had 'only been notified' of the Pope's declaration that the Copernican doctrine was contrary to Scripture and therefore 'cannot be defended or held'. No mention was made in either case of Galileo's having resisted, in that way triggering a personal injunction. Yet in 1632, as we shall see, a record of the injunction's having been administered was produced from the files of the Holy Office.[9]

There is to all appearances an inconsistency here, one that has given rise to more dispute among commentators, perhaps, than any other feature of the Galileo case. A variety of attempted resolutions have been put forward since the documents of the trial were first published more than a century ago. The most extreme is that the record was forged in 1632 to incriminate Galileo;[10] but that is unlikely – for one thing, the handwriting appears to be that of the original notary. A second suggestion is that Galileo did resist and the injunction was thus legally administered;[11] which is possible but also unlikely: Bellarmine would surely not have glossed this over so expressly. A third is that Segizzi, unhappy with the outcome, wrote up a report after the fact although the injunction had never, in fact, been administered.[12] A fourth is that Segizzi did (improperly) administer the injunction, even though Galileo did not resist, perhaps interpreting some dismayed reaction on Galileo's part as resistance.[13] In the end, all we can really conclude with any assurance is that the injunction was, in one way or another, irregular.

5. What was the issue in 1616?

What led the Church to act as it did in condemning the Copernican doctrine in 1616, with such far-reaching effects? One often reads that it was 'old science' versus 'new science', that the Roman theologians saw themselves as defending the natural philosophy of Aristotle, happily consonant with their theology, from the incursion of a new and hence potentially threatening sort of science. There are two problems with this. First, the 'new science' of Galileo still lay twenty years in the future, in his two great works of the 1630s. The theologians of 1616 had not the slightest inkling of what was in the offing in that respect, any more than had anyone else at the time. Galileo's case for the Copernican position in 1616, novel though it was, gave no hint of the transformation soon to come, even in the very notion of science itself. It is true, however, that Galileo was calling on a new sort of evidence,

3 Fantoli, A. *Galileo: For Copernicanism and for the Church,* Rome: Vatican Observatory Publications, 3rd ed. (2003), chap. 2.

4 McMullin, E., 'Galileo's theological venture', in McMullin, *op. cit.,*(2), 88-116 (pp. 99-102).

5 *Ibid.,* pp.105-111.

6 Suggested by Shea, W.R. and Artigas, M. *Galileo in Rome: The Rise and Fall of a Troublesome Genius,* Oxford: Oxford University Press (2003).

7 Finocchiaro, M. *The Galileo Affair,* Berkeley: University of California Press (1989), p. 146.

8 The reason for the difference was presumably that the biblical passages on the motion of the sun (particularly the one where, in response to Joshua's request in battle (*Josh.10:* 12-14), God is said to still the sun's motion temporarily to allow the Israelites additional time to finish off their enemies) were more explicit than those mentioning the immobility of the earth.

9 It is not the original notarised document, with the requisite signatures. Abbreviated records of this sort *(imbreviatura)* were, however, standard in the Holy Office files. See Beretta, F. *Galilée devant le Tribunal de l'Inquisition* (Fribourg, 1998), 170; Fantoli, A. 'The disputed injunction and its role in Galileo's trial', in McMullin, *op. cit.,*(2), 117-149, (121-122).

10 Wohlwill, E. *Der Inquisitionsprozess des Galileo Galilei,* Berlin (1870), 5-15.

11 For example, Shea and Artigas, *op. cit.,* (6), p.83.

12 De Santillana, G. *The Crime of Galileo,* Chicago: University of Chicago Press (1955), p.266.

13 Fantoli *op. cit.,* (9), pp. 124-126.

a rival source of epistemic authority that had not previously been tested in the theological context.

But the theologians would hardly have thought of themselves as coming to the defence of Aristotle's natural philosophy in the first place. Bellarmine, the leading theologian among them, was already critical of that philosophy. Others among them would have thought it in no need of defence. What was threatened, what called for defence on their part, was clearly the integrity of Scripture.[14] In the aftermath of the Counter-Reformation Council of Trent and its strictures concerning Scriptural interpretation, the integrity of Scripture was taken to imply that one should understand it literally unless compelled to interpret it otherwise.[15]

Nor, as the theologians saw it at least, might the condemnation in 1616 be described by the 'theology versus science' label later so often attached to it. In 1616, natural philosophers more or less unanimously regarded the Copernican innovation as no more than a useful calculational device. The consultors of the Holy Office in 1616 undoubtedly believed the best natural knowledge (the 'science') of their day to be on their side. That was what allowed them to characterise the Copernican claim as 'foolish and absurd in philosophy', a premise that encouraged them to word their negative theological judgement in definitive language.[16] Their error was to overlook the possibility, so tellingly pointed out by Galileo in his letter to Castelli, that new discoveries can undermine even the most secure-seeming certainties, a process already clearly under way in astronomy.

Where the Roman theologians went wrong was primarily, however, in their theology. The notion of accommodation that Galileo called on in his *Letter to Castelli* was a commonplace of earlier biblical exegesis. It applied quite clearly, and for multiple reasons, to the biblical passages mentioning the earth's immobility and the sun's motion. But their literalist mind-set was simply too ingrained at this point to allow them to recognise this. One wonders whether the outcome would have been different had the theologians grappled with the clearly relevant passages from Augustine that Galileo marshalled so effectively in his *Letter to the Grand Duchess*.

Part Two: The Dialogue and the trial of Galileo

1. Leading up to the Dialogue

Back home in Florence, Galileo prudently kept away from the Copernican issue but became embroiled in astronomy-related controversies. A debate with the Jesuit philosopher, Oratio Grassi, about the nature of comets, turned rancorous, leading to the publication of *The Assayer* (1623), a brilliant satirical work whose passing advocacy of atomism led Grassi and an unknown critic, who lodged a complaint at the Holy Office, to urge that this compromised the doctrine of the Eucharist. So far as we can tell, the complaint was not followed up.[17]

The election of Galileo's friend and admirer, Cardinal Maffeo Barberini, as Pope Urban VIII in 1623 encouraged Galileo to appeal to him for permission to proceed with a treatment of the Copernican issue, which was granted but with the proviso that it should be 'hypothetical', by which the Pope evidently meant: not claiming demonstration. A theological argument with a long pedigree convinced him (as he told Galileo) that to claim to *demonstrate* the hidden cause (e.g. the earth's motions) of an observed phenomenon (e.g. the tides) would be implicitly to deny that the Creator *could* bring these effects about in a different way. But Galileo appears to have taken 'hypothetical' in more or less the modern sense, permitting the presentation of the best case possible.

Despite ill-health, he worked on an elaborate defence of the Copernican system. No longer relying simply on his telescopic discoveries, all he had to offer in 1616, he now outlined a new account of motion, one that undercut the Aristotelian arguments against the earth's motion, and in addition presented an argument in canonical causal form attributing the terrestrial tides to the earth's motions. The telescopic discoveries had already refuted the Aristotelian-Ptolemaic systems, showing that the earth could not be the centre of the planetary rotations. The tidal argument was clearly shaky but the other arguments had left only the Copernican alternative standing.

Or had they? Galileo never explicitly addressed the question of the third 'chief world-system', that of Tycho Brahe. Formulated in the 1580s, it retained the earth at the centre but had the sun revolve around the earth, carrying with it the planets. Observationally, the Tychonic and the Copernican systems were equivalent. Despite that fact and the growing support for the Tychonic system among those who for physical or theological reasons were wary of the Copernican choice, Galileo never seems to have taken this alternative seriously, other than hinting in the *Dialogue* that a huge solar entourage could not possibly maintain a stable orbit around a relatively tiny earth.

2. The Dialogue on Two Chief World Systems

Getting the manuscript of the Dialogue through the Roman censorship proved to be a lengthy affair. The Dominican censor, Niccolò Riccardi, was well disposed to Galileo but was clearly troubled by the author's barely concealed affirmation of the supposedly condemned Copernican system. He knew, of course, that Galileo had the Pope's permission to write about the Copernican topic. But how much latitude had he been given? To be on the safe side, Riccardi instructed Galileo to write an introduction and a closing passage in which it would be made clear that the work was intended only as a 'hypothesis', again the fatally ambiguous term. Eventually, he authorised the Florentine censor to make the final decision. The book appeared finally in February 1632.

It arrived in Rome at a most inauspicious time. The Pope was under attack from the Spanish faction in the Curia for supporting France and thus, indirectly, its Protestant ally, Sweden, against the Catholic Hapsburgs.[18] He was also being accused of nepotism and of worldly aggrandisement. He was thus in no mood for a further perceived slight. Not only was the Copernican claim being presented as much more, in his eyes, than the 'hypothesis' that had been agreed upon, but also the Pope's own theological reservation about the possibility of demonstrating that claim had been implicitly called into question. Worse still, it had been reduced to an inadequate closing comment from Simplicio, elsewhere in the *Dialogue* almost invariably the spokesman for the losing side.

In September, the Tuscan ambassador, Francesco Niccolini, tried to intercede with the Pope on Galileo's behalf but was met (as he later described it) with an 'outburst of rage' against Galileo who had 'deceived' him and 'had dared to enter into the most serious and dangerous subjects that could be stirred up at this time'.[19] To make matters worse, a record was found in the Holy Office files of Segizzi's having delivered the personal injunction to Galileo in 1616 forbidding him 'to hold, teach, or defend' the Copernican view 'in any way whatsoever, verbally or in writing'. Since he had not let the censors of the *Dialogue* manuscript know of this, it would immediately be argued that this invalidated the *imprimatur* given him for the book. At this point, the Holy Office took over and he was ordered to appear before it.

3. The trial

Galileo tried for several months to delay the long journey to Rome on the grounds of age and ill-health but Urban was adamant. He arrived finally in February 1633. One unusual concession would be made: he

14 McMullin 'The Church's ban on Copernicanism', in McMullin *op. cit.,* (2), 150-190, pp.177-182.

15 Pedersen, O. *Galileo and the Council of Trent,* Vatican City: Vatican Observatory Publications (1983).

16 According to their principles, the weaker assessment 'not demonstrated' could still have allowed a theological warning but one open, technically speaking, to later amendment, unlike the actual decree which left no opening for later modification. This last later became a matter of debate.

17 The efforts of Pietro Redondi to make this the real, though carefully concealed, issue in the later trial of Galileo have not convinced many. See his *Galileo Heretic,* Princeton: Princeton University Press (1987). For a critique, see Westfall R.S. *Essays on the Trial of Galileo,* Vatican Observatory Press (1989), pp.84-99.

18 Redondi *op. cit.,* (17), pp.227-232.

19 Finocchiaro *op. cit.,* (7), p.229.

was allowed to stay at the comfortable Tuscan embassy, in the care of his good friend, Niccolini.[20] His trial consisted of a series of interrogations by the Commissary of the Holy Office, Vincenzo Maculano, in the presence simply of a notary, with a view to getting the accused to admit that he had defended the proscribed doctrine and then persuading him to renounce it.

The aggravating charge against Galileo was that he had received a solemn injunction from Segizzi and had ignored it. But then Galileo produced the certificate he had received long before from Bellarmine (who in the meantime had died) that seemed to imply that no such injunction had been given. This obviously came as a shock to the Commissary who tried, unsuccessfully, to get him to recall there having been an additional injunction. He then shifted his questioning: had Galileo not violated Bellarmine's command, at least, by defending the forbidden view in the *Dialogue?* But Galileo kept insisting, disingenuously, that his book did not really do so, frustrating Maculano, all the more because a commission appointed by the Holy Office had reported unanimously that the book did undoubtedly defend the Copernican position.

At this point, the Commissary, hoping for a lenient solution, the evidence suggests, got permission to deal with Galileo 'extrajudicially' to extract the needed confession. What he got was not the confession he hoped for but only the admission that Galileo had because of 'vain ambition' made the pro-Copernican arguments stronger than he should have done and the surprising offer to add to the *Dialogue* a section refuting his own pro-Copernican arguments. But all of this was in vain. The Holy Office moved to judgement. A summary of the evidence, including the interrogations, was sent to the cardinal-judges who would decide the case.

The summary, as we now know, was seriously deficient in several respects. It took for granted that the personal injunction had, in fact, been delivered to Galileo in 1616; Bellamine's report that Galileo had acquiesced was not mentioned. Further, the injunction was attributed to Bellarmine, not Segizzi, allowing the (incorrect) assertion that Galileo had specifically admitted to its having been administered. There were also some tendentious misquotations.[21] But for the judges, the matter was already clear: Galileo had defended a proscribed position that had been declared contrary to Scripture, one that, besides, Bellarmine had specifically ordered him to abandon.

The outcome was never in doubt. In June 1633 Galileo was sentenced for 'vehement' suspicion of heresy. The status of the Copernican doctrine itself was left undefined. The personal judgement on Galileo was consistent with the more severe verdict of heresy or the weaker verdict 'erroneous in faith' in regard to the doctrine itself. Technically, the latter was the correct verdict when the other was not explicitly specified. Galileo was ordered to abjure the condemned view. Refusal to abjure would have incurred burning at the stake. Galileo abjured and was sentenced to permanent house arrest. The texts of the condemnation and abjuration were to be communicated, under Urban's express authority, to university teachers of 'mathematics' (astronomy).

4. Assessment

Galileo was undoubtedly guilty, as charged, of defending the suspect doctrine in the *Dialogue*. He had obviously hoped that the greatly strengthened case he could make for the Copernican position in the *Dialogue* would be enough to lead the Pope to withdraw the earlier condemnation. But as far as the Pope and his advisers were concerned, the scientific issues were no longer relevant; they never came up for discussion in the trial. That matter had been decided in 1616.

What is one to say of the trial itself? There were several troubling features. First was the flawed summary of the interrogations that was supplied to the judges. Then there was the reliance of the judges on the disputed injunction from 1616. A more complex issue was the assumption throughout the trial, made explicit in the trial-sentence and abjuration, that maintaining the Copernican position constituted suspicion of heresy. Prior to the trial, this had never been specifically proclaimed. In 1616, the decree of the Index had quite explicitly been restricted to the critique 'contrary to Scripture', despite the recommendation of 'heretical' from the consultors. The Index charge *could* have been interpreted as implying the lesser charge of 'rash', not calling for a trial or abjuration, as Urban himself on an earlier occasion seemed to imply.[22] But now the judges had reverted to the far more serious verdict of the original consultors. They were legally entitled to do so especially if Urban was invoking his objection about the Copernican compromising of the Divine freedom. His ignoring Bellarmine's admonition could, of course, have been invoked instead. But that of itself would hardly have merited the suspicion of heresy. And, in any event, in the Sentence as it stands, that was not the substantive charge actually relied on.

Galileo returned to strict house-arrest in his home near Florence. Resuming the researches in mechanics left aside twenty years before, he put together his most important work, the *Two New Sciences,* whose appearance in 1638 was to combine mathematics and experiment in a new and fruitful way that would rapidly transform the science of nature. Burdened by the loss of eyesight, he died in 1642 and was buried in the church of Santa Croce in Florence. A proposal for a mausoleum in his honour was set aside: Urban had not forgiven the man who, as he put it, 'had given such universal scandal'.[23]

Epilogue

With Galileo's death, the Galileo Affair might be said to have ended. But in a sense it was not really over: a new affair was in the making, as critics took the Church to task for its treatment of Galileo and the Church struggled with the legacy of a decree it was reluctant to admit had been in error. In 1992, Pope John Paul II finally declared that the theologians of 1616 had been mistaken.[24] But that would be another story.[25]

20 So much for the legend, dating back to Voltaire, of Galileo's 'having groaned away his days in the dungeons of the Inquisition' in 'Descartes and Newton'. See Finocchiaro, M. *Retrying Galileo* 1633-1992, Berkeley: University of California Press (2005), pp.115-119.

21 Fantoli *op. cit.,* (9), pp. 323-326.

22 In 1624, Cardinal Zollern informed Galileo that Urban had told him that the Church had not condemned the Copernican teaching as heretical but only as rash (*Opere di Galileo Galilei,* Florence: Giunti Barbera, 1968, vol. 13, p. 182).

23 Speaking to Niccolini after Galileo's death; Fantoli *op. cit.,* (3), pp.349-350.

24 The address prepared for the Pope's delivery on that occasion did not do justice to the Pope's evident desire to set the Galileo debate finally to rest. See Coyne, G.V. 'The Church's most recent attempt to dispel the Galileo myth', in McMullin *op. cit.,* (2) 340-359.

25 It is told in Finocchiaro *op. cit.,* (20).

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