The trial and resulting abjuration of Galileo before the Holy Congregation of the Catholic Church, which occurred at the convent of Minerva on the 22nd of June, 1633, has been studied by scholars and laymen alike for several hundred years. Not surprisingly, the sheer number of personalities involved, together with the many aspects playing a part in political, religious, philosophical and scientific affairs over the course of Galileo's life, have given rise to a great many interpretations of what happened and—perhaps more importantly—why.

Introduction

What happened to Galileo has been examined at length as an historical event that can shed light on a few specific questions:

- What is the relationship between science and religion?
- How did modern science develop and why?
- What is the relationship between science and society?

Although it has also been viewed as a human tragedy (Brecht, 1966), the first of these has tended to be paramount. Some perspectives seemed well-supported by a cursory glance and the trial has since come to be known as a paradigmatic example of the inherent conflict between science and religion.

The Myths

According to one such interpretation, Galileo knew the Earth to go round the Sun (as Copernicus had written) rather than the converse (as implied in several Biblical passages). The Church would not allow science to disprove the revealed truth of Scripture, however, and hence threw Galileo to the Inquisition where he was forced under threat of torture to disclaim this opinion and never speak of it again. He was then imprisoned under house arrest for the remainder of his life, a clear example of the conflict between scientific investigation of the world around us and the presumed infallible authority of the Bible.

Another, less well-known myth states instead that the Church had been correct to deal with Galileo as it did. Having seen no convincing scientific evidence or reasons to abandon the Ptolemaic Earth-centred system, the Church ignored Galileo's skilful rhetoric and held to the eminently reasonable approach of not abandoning an idea that was supported both by common sense and Scripture for an alternative that was unproven and had more than enough problems of its own. Galileo was trying to force society and religion to adjust to ideas that were either disputed or inconclusive, and he was rightly rebuffed and his objections dismissed.

In this essay we shall look at Galileo's early life before considering in more detail the events that became known as The Galileo Affair. Following Finocchiaro (1989, 10), we shall distinguish between non-intellectual (political, personal and social) and intellectual (theological, philosophical and scientific) factors before looking at the trial and its consequences. We shall also consider the recent position taken by the Church under John Paul II and the new fictions introduced thereby. Under the weight of all these diverse aspects, these myths will hopefully give way
to a deeper appreciation of the whole affair. Initially, however, we shall reflect on the astronomical problem that provides the overall context for what is to come.

Unless otherwise noted, all references are to Antonio Favaro’s *Edizione Nazionale delle Opere di Galileo Galilei*, with the volume and page numbers given by Roman and Arabic numerals respectively. This is the standard collection of works and correspondence in Galileo studies.

**Astronomical Systems**

In order to understand the debate that had been ongoing in European religious, philosophical and scientific circles since the publication of Copernicus’s *De revolutionibus orbium celestium* in 1543, we first need to understand the different terms and world systems involved. From the time of Aristotle (384-321 B.C.E.) it had been thought that the Earth stood still (which we call *geostaticism*) at the centre of the universe (and hence *geocentrism*). Everything in the universe was part of one of two distinct worlds: that made up by the *sublunar* and that of the *heavenly* bodies. The former were made up of earth, fire, air and water, each of which had its *natural motion*: earth and water, being heavy, moved from high to low; while fire and air, being light, moved from low to high. Once something reached its natural *place* it no longer moved—much like a pendulum slowing down until it reaches an equilibrium. This meant that the sublunar world must consist in a core of earth with the other elements arranged in "shells" around it—water, air and fire. Since the Earth was mostly earth, it sat at the centre of the universe and did not move.

The simplified *Ptolemaic system*, sometimes called *Aristotelian*

The heavenly bodies, being separate, could not be composed of the four elements, so Aristotle invoked a fifth—the *ether*. They could not move toward the centre, since that was occupied by the Earth, so their natural motion had to be *circular*, becoming neither closer nor farther away as they moved. A circular motion, however, could continue indefinitely in one direction, hence there would be no opposition and so no change. The heavenly bodies, then, were *immutable*. All this was set in motion by God, the final mover, the result being much like an onion: a central Earth surrounded by concentric spheres, just as the onion is made up of a centre around which the layers are arranged one on top of each other.

Although much of this model seemed confirmed by observation and common sense, it struggled to explain phenomena that became increasingly familiar to early astronomers. Why did the brightness of the planets vary? What of *retrograde* motion, where a planet appeared to move eastward for most of the year but then to go back on itself, westward, before heading east again—tracking a loop across the heavens, as it were? These difficulties
made it hard to claim that the Aristotelian representation could be an accurate picture of the universe.

This situation changed significantly with the work of Ptolemy, who is estimated to have lived circa 100-178 C.E. His *Almagest* (a name given to it by the Arabs, from *al*—the Arabic "the"—and *megiste*—the Greek "greatest"— to set it apart from another textbook called *The Little Astronomer*) was based on observations from 127 to 151 and gave a mathematical account of the movements in the heavens. In particular, he affirms in chapters five and seven of Book One that the Earth is central and does not move. His explanations were based on three principles:

- The *eccentric*, according to which the Earth is not at the centre of planetary orbits but slight off.
- The *epicycles*, according to which a planet revolved around a circle (an epicycle) which, in turn, was centred on a deferent. The deferent could itself be on another deferent, and so on, allowing Ptolemy to account for retrograde motion.
- The *equant*, according to which the angular velocity (or speed of revolution) of a deferent was not constant with respect to its centre but instead off-set slightly at an equant point, so that the angular velocity would be greater the farther away from the equant, and vice versa. This would help explain the speeding up of the planets at various times of the year.

With these mathematical devices, Ptolemy was able to describe the motions of the planets in mathematical terms so successfully that his account was still in use some 1400 years later. Although he himself tried to interpret his work realistically in his *Hypothesis on the Planets*, a lasting consequence of his treatment was the separation of astronomy and natural philosophy (or what we would now call *science*): on this view, the task of the astronomer was not to give a true explanation of the structure of the universe and how it functions, but merely to offer a tool or instrument of prediction to help in calculating positions when required.

The first *geokinetic* ("moving Earth") system was implicit in that of Philolaus in approximately 475 B.C.E., which, though now lost, was referred to by Archimedes and others. A true *heliocentric* ("sun centred") approach was devised by Aristarchus of Samos in the fourth century B.C.E. This was not *heliostatic* (i.e. the Sun standing still) since the Sun rotated on its own axis. His account was rejected by Aristotle and others because of the theory of natural place (explained above), the lack of any common experience that suggested its truth, and—most importantly—because the phenomenon of stellar parallax was not noted.
This was an argument that noted that, on the assumption of a moving Earth, the line of sight from an observer to a star would not remain parallel over the course of a year but would vary. Aristarchus thought that this was because the universe is so vast in extent that the change would be negligible, but, with his system not coming close to the mathematical sophistication of Ptolemy’s, this idea was rejected along with the motion and rotation of the Earth.

With some other minor developments that are beyond the scope of this essay, this was how matters remained until the publication, on his deathbed (literally), of Nicholas Copernicus’s (1473-1543) *De revolutionibus orbium celestium*. In this work he gave a mathematical account of a universe centred on the Sun, in which all the planets (and the Sun itself) rotated on their axes and around the Sun.

Although Copernicus interpreted his model not as an instrument but as a description of reality, a preface was added to his work by Andreas Osiander that asserted to the contrary in order to avoid the censure of the Church. The reception given to Copernicanism varied between countries and over time, but one of the most important responses was given by the Danish astronomer Tycho Brahe who developed an alternative system, according to which the planets orbited the Sun and the Sun, in turn, orbited the Earth. This Tychonic view retained geocentrism and geostaticism, winning the support of astronomers in the instrumental tradition. Others, however, complained that it was merely a mathematical concession that did not address the physical difficulties with the Ptolemaic system, which were raised anew by the appearance of many comets between 1577 and 1596. Aware of these issues, Brahe could not bring himself to accept Copernicanism. A more detailed account of the
background may be found in a study of the history of astronomy (cf. Kuhn, 1971 and Fantoli, 1996 for recent examples), but this was the situation when Galileo arrived on the scene.

Galileo the Man

Galileo Galilei was born in the environs of Pisa on the 15th of February, 1564, the son of Vincenzio Galilei, a musician and teacher of music who emphasised the use of experiment and was scornful of any deference to authority. His mother was Giulia Ammanati, known from her letters to have been a difficult woman. He was schooled initially by the monks at Vallombrosa until his removal by his father due to problems with his eyesight, and was later enrolled at the University of Pisa in 1581 to study medicine. In 1583 he began to take private lessons in mathematics from Ostilio Ricci, a tutor associated with the Tuscan court. His father's disagreement with this change of direction was assuaged somewhat by Ricci's intervention. Galileo left the university without graduating, intending to devote his efforts to mathematics, but unable to win a scholarship from the Grand Duke.

Some work on the centres of gravity of solids won Galileo the admiration of Christopher Clavius, a famous Jesuit mathematician whom he visited in Rome in 1587, together with the patronage of the Marquis Guidobaldo del Monte. Both were able to use their influence to help Galileo gain the chair of mathematics at his old university in 1589, having failed the year previously to win the same position at the University of Bologna. It was in Pisa that he was reputed to have carried out his famous experiments, dropping weights from the leaning tower.

More accurately, these were demonstrations, not experiments, because Galileo already knew what to expect from his childhood experience of watching falling hailstones of different sizes striking the ground at the same time and the prior suggestion and testing by others of this result—contrary to Aristotelian teaching (Giambattista in 1553 and Stevin in 1586; cf. Drake, 1999, 1: 8). (According to Aristotle's ideas on impetus and place, a heavy stone should fall proportionately quicker, attempting to regain its natural place.) Although some historians of science have doubted whether this celebrated incident ever occurred (Koyre, 1978 and Dijksterhuis, 1969: 336, for example), the matter was settled by Thomas B. Settle's repetition, observation and explanation of the curious fact that the heavier ball descends slightly behind the lighter—a puzzling circumstance noted by Galileo and found by Settle to be due to differential muscular fatigue, leading to the early release of the lighter ball even though the holder believes the release to be simultaneous (Cohen, 1992: 195; see also Drake, 1999, 1: 309 for how Settle's work ousted the Koyrean programme within Galileo studies).

Soon after his arrival at Pisa, Galileo had written a paper on mechanics that would perhaps have been sufficient to displace Aristotelianism and certainly win him a reputation in the wider world (Drake, op cit, 28). He preferred instead to continue working and ultimately never published it. We should bear this in mind when considering the
later suggestion that he lacked prudence or defended ideas he knew to be untenable.

Disappointed with his prospects of advancement, Galileo resigned from his position in 1592 and, again with the aid of Guidobaldo, took up the chair of mathematics at the University of Padua, then part of the Venetian Republic. The intellectual climate there was more to his liking, the government in Venice being easily the most tolerant of the Italian states while the great Vesalius had taught at the university. There Galileo met and befriended Giovanfrancesco Sagredo, who would later take the third role in Galileo's Dialogue. In his time at Padua he invented several devices that found medical applications after their adaptation by Sanctorio Santorius, the professor of medicine. It was here also that Galileo first met Roberto Cardinal Saint Bellarmine, who would play such an important role in later events. Galileo lodged for a time with G.V. Pinelli and it is reckoned that a later meeting there, involving Bellarmine and Cesare Baronius—the latter a cardinal, too—was the source of a maxim attributed to Baronius by Galileo some years hence, according to which "the Bible tells us how to go to heaven, not how the heavens go." (Drake, op cit.)

In 1597 Galileo was given a copy of Johannes Kepler's Precursor of the Cosmographic Dissertations or the Cosmographic Mystery and struck up a correspondence with the author. They discussed Copernicanism and Galileo mentioned his concern at the fate of Copernicus's ideas (X, 68). Also in 1597, Galileo invented a "geometric and military compass", or what we would today call a sector. In 1599 he began to manufacture these commercially by taking on a craftsman, such was their utility. Over the next few years he was able to prove several theorems concerning motion on inclined planes and discovered the law of falling bodies.

Although he never married, Galileo formed a relationship with Marina Gamba and had two daughters, in 1600 and 1602, followed by a son in 1606. He was utterly devoted to his eldest daughter, Virginia, who wrote many letters to him and maintained his spirits during his later difficulties with unwavering faith in him. When she died in 1634, he was inconsolable and probably never recovered from his loss.

In 1604 an event occurred that perhaps marked the beginning of his troubles with the philosophers. A supernova was observed in the night sky and Galileo was called upon to give lectures on it. These were so popular that no spare seats could be found and Galileo pointed to what had occurred in the heavens as evidence that Aristotle had been incorrect in supposing that the sphere beyond the planets was composed of a perfect and immutable quintessence that could not be altered.

The Paduan professor of philosophy, Cesare Cremonini, replied to Galileo in a small booklet, to which the latter responded in turn—probably in collaboration with his friend Antonio Querengo—by composing a dialogue in rustic Paduan dialect between two peasants (Drake, op cit). In this work the peasants made a mockery of the Aristotelians and, although published under a pseudonym, it was widely known to have been Galileo's creation. A student in Padua called Baldessar Capra criticised this work in a pamphlet of his own, in addition to plagiarising the handbook that Galileo had written for the use of his military compass. In 1607, Galileo published his Defence against the calumnies and impostures of Baldessar Capra, in which he answered these objections alongside an account of bringing the theft of his ideas to the attention of the authorities. During the resulting trial he had demonstrated that Capra did not sufficiently understand either the instrument or the principles behind it. Capra's work was prohibited and he was expelled, while Galileo was never again so open with his ideas.

Hard at work on theorems concerning materials and motion, Galileo discovered that projectiles follow parabolic paths but did not publish his thoughts until late in his life. The event that compelled him to put these inquiries aside was to have a profound influence on his work: the invention of the telescope. In 1608 the Dutch optician Hans Lippershey had built the first example and tried to patent his invention. Hearing about it from his friend Paolo Sarpi, Galileo realised that he could manufacture his own from convex and concave lenses placed at the objective
and eyepiece ends of a tube respectively. Able to achieve a nine-fold magnification, he presented his telescope to the Venetian government and was offered an appointment for life together with an increased salary. On further examination, however, it transpired that no new raises would be permitted. Galileo was hoping for a better deal, so he continued to develop his telescope and looked to the Tuscan Court instead.

Galileo's Telescope.

By 1610, Galileo's telescope could magnify thirty times and he did something that very few had thought to do (although there is evidence that Thomas Harriot had already been observing the moon—cf. Cohen, 1992: 185): armed with this new tool, he turned his augmented attention upwards to gaze deeper into the heavens than anyone before him. Close attention to and sketches of what he saw over a period of many nights revealed to him that the moon was not smooth at all but mountainous. He also discovered vast numbers of stars and the four satellites of Jupiter. Publishing the results of these investigations in his *Sidereus nuncius* (or *Starry Messenger*), he dedicated the work to Cosimo II de' Medici, his former student and now Grand Duke of Tuscany. Christening the four moons the "Medicean Stars" in a shrewd move, Galileo applied for and was granted the position of Chief Mathematician and Philosopher to the Grand Duke, as well as Chief Mathematician of the University of Pisa with no requirement to either teach or live there. He was also granted a salary of 1000 *scudi*, a large amount of money at that time and which was soon to rouse the envy of other ducal courtiers (although it was nothing like the pay of a professor of philosophy—a circumstance that would bother him throughout his later life).

In Florence, Galileo observed the phases of Venus and the strange form of Saturn. He received Kepler's *Conversation with the Starry Messenger*, offering the latter's support for his discoveries. Nevertheless, there were plenty of hostile reactions: a gathering led by Giovanni Magini, professor of mathematics at Bologna, had been unable to see the Medicean Stars through the telescope, even with Galileo present to help them; Martin Horky, a student of Magini's, published *A Very Short Excursion Against The Starry Messenger*; and Ludovico delle Colombe wrote *Against the Earth's Motion*, in which he marshalled religious criticisms of Galileo's ideas. Cesare Cremonini and Giulio Libri, professors of philosophy at the universities of Padua and Pisa respectively, refused even to look through the telescope. Christopher Clavius in Rome stated that the satellites were a trick of the lenses, not real objects in the heavens.

In spite of these difficulties, Galileo gave three public lectures in Padua and the Jesuits in Rome, including Clavius, verified his observations as soon as they obtained a suitably powerful telescope. Finally, on the 20th of March, 1611, Galileo arrived in Rome where he was feted as a hero, welcomed by Cardinals and provided with opportunities to give demonstrations in the gardens of the rich and powerful. He was granted an audience with Pope Paul V, inducted into Marquis (later Prince) Federico Cesi's *Accademia dei Lincei* (the *Academy of the
Lynx-Eyed, the first scientific academy) on the 25th of April, and was received with much ceremony by the Jesuits at the Roman College on the 13th of May where an address entitled *The Sidereal Message* was read in his honour in the presence of the entire College and many Cardinals.

At this point, then, Galileo was at the apex of his fame. However, there were plenty waiting in the wings to attack him and those who already had, for a variety of reasons. It is to these reasons that we shall now turn.
**The Galileo Affair, Part 2: Non-intellectual contexts**

By Paul Newall (2005)

**Non-Intellectual Contexts**

From his time as a student (Drake, 2001: 17), Galileo had been known as someone who willingly opposed orthodoxy. Even so, the social environment in which he found himself presented him with other obstacles to navigate, including the political climate, the patronage system and the rivalries engendered by those envious of his position or angered by his ideas.

**The Political Setting of the Galileo Affair**

The Protestant Reformation had begun in 1517 with Luther's theses nailed to the door of the Wittenberg cathedral, followed swiftly by the Council of Trent from 1545 to 1563 and the Catholic Counter-Reformation. In the wake of Protestant calls for greater interpretive leniency in reading the Bible, the Council had decreed that

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**Quote**

... no one relying on his own judgement shall, in matters of faith and morals pertaining to the edification of Christian doctrine, distorting the Holy Scriptures in accordance with his own conceptions, presume to interpret them contrary to that sense which holy mother Church, to whom it belongs to judge of their true sense and interpretation, has held or holds, or even contrary to the unanimous teaching of the Fathers... (Schroeder, 1978: 18-19)

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Ostensibly, then, we would expect this to have given Galileo pause insofar as his work might call for a re-evaluation of those passages that appeared to straightforwardly speak of a Earth that does not move (for example, Proverbs 8:25 and 27:3, Job 26:7, Ecclesiastes 1:5, 1 Chronicles 16:30 and Psalm 104:5). As we shall see later, Galileo indeed had the "teaching of the Fathers" in mind. In this Reformation context, however, the Church was perhaps understandably wary of allowing any further adjustment or latitude in determining the meaning of Scripture; after all, if one reinterpretation was possible, why not others?

Shortly after Galileo's telescopic discoveries, in 1618, the Thirty Years War began. Partly religious and partly political in character, it placed successive Popes in difficult positions—none more so that Urban VIII, who occupied the Papacy at the time of Galileo's trial. Under pressure to provide troops and funds to the King of Spain and the Holy Roman Emperor, he had tried to play the two sides against one another to limit the power of the Hapsburgs and to repay a debt to the French who had aided considerably in his election as Pontiff. Galileo, as we know, was a Tuscan and representative of the Grand Duke, who was allied with Spain. When Urban chose, on the 8th of March 1632, to rid his staff of all Spaniards in response to public criticism from the Spanish Cardinal Gaspare Borgia, one of those exiled was Giovanni Ciampoli, correspondence secretary to the Pope and a man who proved instrumental in arranging the publication of Galileo's *Dialogue*. The significance of this will become clear later.

Lastly, since its creation in 1540, Loyola's Society of Jesus had been immensely successful in its intellectual and pedagogical battle with Protestantism and the Jesuits enjoyed an unrivalled reputation within the Catholic
world. This had irked their Dominican brothers and it is interesting to study from which side and which times the support for Galileo from these two came. We have already seen that the Jesuits lauded Galileo's telescopic achievements in 1611; a response from some of the Dominicans was not long in coming.

**Galileo and Personal Rivalries**

Galileo did not dignify Colombe's critique of his *Sidereus nuncios* with a reply, but in 1611 he became involved in a discussion with two of the (Aristotelian) professors of philosophy at Pisa on the question of ice floating on water. Following Aristotle, the latter pair concluded that ice floated because of its flat shape that opposed its sinking; Galileo, on the other hand, referred to a theory of Archimedes and held that it is the respective densities of the ice compared to water that leads to sink or float. Colombe, never too far away, seized on this disagreement and proposed a public debate in which he would take on Galileo.

![Galileo's Sidereus Nuncios](image)

Advised otherwise by the Grand Duke, Galileo wrote some notes on the issue that he expanded into booklet form after a dinner attended by Cardinals Ferdinando Gonzaga and Maffeo Barberini in which he opposed a defence of the Aristotelian position given by Flaminio Papazzoni, another professor of philosophy at Pisa. Published as a *Discourse on objects which rest on water or which move in it*, it explained experiments that could be carried out by anyone interested in seeing for themselves rather than relying on the authority of Aristotle. Colombe responded with *An apologetic discourse concerning the discourse of Galileo* but Galileo preferred to avoid any further controversy and allowed his friend and former student, Benedetto Castelli, who had replaced him at Pisa as professor of mathematics, to reply in his stead. Unfortunately this course of action was unsuccessful and Galileo learned of the existence of a letter (XI, 241-242) of the 22nd of September, 1612, addressed to Alessandro Marzimedi (Archbishop of Florence and well-disposed to Galileo) who had ensured that a copy would find its way to his friends. This correspondence spoke of the formation of an organised group of Florentines in opposition
to Galileo, lead by Colombe and meeting at Marzimedi's home. There they conspired to bring about a controversy on the question of the Earth's motion and had hopes to incite one of their number to preach against Galileo from the pulpit. This group was called by Galileo's friends the League of Pigeons ("Colombe" being Italian for "dove"). One member of the League, Niccol Lorini, attacked Galileo in private in 1612 for his ideas that—according to Lorini—verged on the heretical but later wrote to him in apology. Another letter was sent to Galileo himself by the painter Cigoli in December of 1611, which explained in more detail:

Quote

I have been told by a friend of mine, a priest who is very fond of you, that a gang of ill-disposed men, who are envious of your virtue and merits, met at the residence of the Archbishop of Florence, and put their heads together in a mad quest for some means by which they could damage you, either with regard to the motion of the Earth or otherwise. One of them asked a preacher to state from the pulpit that you were asserting outlandish things. The priest, seeing the animosity against you, replied as a good Christian and a member of a religious order ought to do. I write this that your eyes may be open to the envy and malice of these evildoers.

Federico Cesi, Galileo's great friend, supporter and patron

Also in 1612, another line of disagreement with Galileo arose. A Jesuit professor of mathematics at Ingolstadt, Christoph Scheiner, had announced his observations of sunspots in a letter of 1611 to Mark Welser, a banker and an amateur scientist in Augsburg. Although sunspots had already been seen by the Dutchman Johann Fabricius who had published a treatise on them at Wittenberg, Welser wrote to his friend Johannes Faber in Rome asking if similar studies had been performed there. Faber was a member of the Accademia dei Lincei and Cesi (and subsequently Faber) soon came to know of the letter, passing on the news to Galileo (XV, 236 and 238-239). Meanwhile, Scheiner continued his work and sent a further two letters to Welser, affirming that the sunspots were, in his opinion, wandering stars (i.e small planets). These letters were published under a pseudonym.

Galileo received a copy of this collection in January of 1612 and wrote a letter to Welser in response, stating that he had not dared to reply without making some further observations of his own because he feared that any minor error on his part would be seized upon "by the enemies of truth whose number was infinite" (V, 94-113). Nevertheless, he argued that the sunspots were not planets but were actually on or very near the surface. Scheiner had continued his own work and sent a further three letters to Welser under the title A more accurate discourse, in which he appeared to dispute Galileo's priority in noticing the sunspots (V, 46)—in spite of their having been known since antiquity and often being visible to the naked eye. Galileo sent a second letter of his own, without having seen the booklet by Scheiner, which he received from Welser in September. Galileo's friends, including Cesi, were insistent that he respond in print to this question of priority (for example, XI, 418 and Galileo
resolved "to make it clear how foolishly this matter has been dealt with" by his opponent, whom he now knew to be a Jesuit (XI, 426). In his third letter, Galileo tackled Scheiner's arguments and rejected the latter's attempts to demonstrate the Tychonian system (proposed by the Dane Tycho Brah, in which the Earth is at the centre of the system with the Sun revolving round it and the planets orbiting the Sun).

The collection of Galileo's three letters were published in 1613 by the Accademia dei Lincei with a preface by Angelo de Fillis, their librarian, in which he attacked Scheiner and claimed priority for Galileo in the matter of the discovery of the sunspots. Galileo himself was wary of this addition and the harm it could do to his standing with the Jesuits. Unfortunately the polemical remarks by Scheiner and Galileo's friends alike had left the former particularly bitter, as would later comments by Galileo in his Assayer. Bound by their adherence to Aristotelian ideas (Constitutiones Societas Jesu, Ganss, 1970: 220), the Jesuits Giuseppe Biancani and François D'Aguilon also continued to state Scheiner's priority, while Galileo's friends rebutted them with zeal. The damage had been done.

Galileo's Motivations

These conflicts and squabbles form one of the subtexts to the Galileo affair and it was not long before his antagonists had another opportunity. In July of 1612, Galileo had written to Cardinal Carlo Conti about sunspots and the questions raised by them. In reply, Conti "stated that Scripture did not support the Aristotelian theory of the incorruptibility of the heavens but that, on the contrary, the common opinion of the Fathers of the Church was that the heavens were corruptible" (Fantoli, 1996: 141). Conti further remarked that the motion of the Earth could be accommodated with the Biblical passages if it was supposed that Scripture was written according to the understanding of ordinary persons, not as consisting in exact astronomical information. This, he added, "should not be admitted unless it is really necessary" (XI, 355). As a result, Galileo had noted in his second letter to Welser that the incorruptibility of the heavens was "not only false but repugnant to those truths of Sacred Scripture about which there could be no doubt" (V, 138-139)—a phrase which was removed by the censor before publication in spite of protests and referrals to Conti's opinion. Even so, a marginal statement on Copernicus (discussing "the truth of the rest of his system" following from a correct—astronomical—understanding of his De revolutionibus orbium celestium(V, 195)) was left alone, encouraging Galileo, according to Fantoli (1996: 170), to
believe that he could broach the subject in more depth and detail.

On the 12th of December, 1613, Galileo's friend Castelli attended a lunch with the Grand Duke. Also present were the Grand Duchess Dowager, Christina of Lorraine, and Cosimo Boscaglia, special professor of philosophy at Pisa and an expert on Platonism. Prompted by Boscaglia whispering in her ear, the Grand Duchess asked Castelli whether the motion of the Earth was contrary to Scripture. Over the course of the meal, Castelli won an admission from Boscaglia that Galileo's discoveries were true and reduced the theological objections to silence, "carr[ying] things off like a paladin" by his own account in a letter describing the events that he sent to Galileo (XI, 605-606). Concerned at this development and the recourse to Scripture when the denial of his observations had proven impossible, Galileo wrote a lengthy reply to Castelli explaining his view of the relationship between the Bible and science (V, 281-288).

Either intentionally or without considering the consequences, Castelli made copies of this letter and some found their way to Galileo's opponents. Matters came to a head when, on the 21st of December 1614, the Dominican Tommaso Caccini preached against Galileo in the church of Santa Maria Novella in Florence, telling his audience that mathematicians, being spreaders of heretical ideas, should be banished from the Italian states (XII, 130). Caccini was associated with the League of Pigeons and this was a calculated attack. Although Luigi Maraffi, another Dominican and a friend of Galileo, wrote to him apologising for such "madness and ignorance" (XII, 127), Galileo was advised against responding by Cesi, who told him that Cardinal Roberto Bellarmine was of the opinion that "the motion of the Earth is without any doubt against Scripture" (XII, 129-130). Galileo decided to leave Caccini unanswered, the latter having already been rebuked by his own brother.

Hearing about the controversy and expressing his displeasure at Caccini's behaviour, Lorini was given a copy of Galileo's original letter by Castelli. On reading this, Lorini, aware of the restrictions on interpretation dictated at the Council of Trent (quoted above), considered Galileo to have overstepped the mark and, believing it to be his duty to do so, sent a copy of the letter to Cardinal Paolo Sfondrati for examination (XIX, 297-298). The latter was Prefect of the Congregation of the Index, created in 1571 by Pius V to halt the dissemination in print of heretical ideas. Since the letter was not in print, however, he passed it on to his colleague Cardinal Giovanni Millini, Secretary of the Holy Office (more commonly known as the Inquisition). Although generally favourable to Galileo, this organisation decided to pursue the matter further and requested a copy of his original letter. Having discussed the matter with their mutual friend Piero Dini and Maffeo Barberini, Ciampoli passed on the latter's advice to Galileo in a letter, stating that he ought to be careful because "not everyone has the dispassionate faculty... [o]ne man amplifies, the next one alters, and what came from the author's own mouth becomes so transformed in spreading that he will no longer recognise it as his own" (XII, 146); in short, to be careful what he
said or wrote because others were want to twist his meaning. Meanwhile, Galileo was increasingly worried that events were overtaking the importance of his work and concentrating instead on Scripture, such that his enemies had "in short, opened a new front to tear me to pieces" (V, 292-293). He was also wary of the possibility that Lorini had not copied his letter faithfully, remarking that "because I have not received the least sign of scruples from anyone else who has seen the letter, I suspect that perhaps whoever transcribed it may have inadvertently changed some word..." Galileo forwarded an accurate copy to Dini, asking him to see to it that Bellarmine should read it (ibid).

Dini did as he was asked, also forwarding a copy to Christopher Grienberger, the Jesuit professor of mathematics who had succeeded Clavius. Both recommended caution, suggesting that Galileo should attend to his investigations and leave Scripture alone, at least for the time being. Galileo responded by hinting at a work in progress and stating unequivocally that he had "no other aim but the honour of the Holy Church" and that he did not direct his labours "to any other goal..." (V, 299-300). Galileo, however, was encouraged by the news that Paolo Antonio Foscarini, a Carmelite professor of theology at the university of Messina in Calabria, had published his Letter on the opinion of the Pythagoreans and of Copernicus in 1615. Cesi brought it to Galileo's attention, stating that it "certainly could not have appeared at a better time, unless to increase the fury of our adversaries is damaging, which I do not believe" (XII, 150)—a misplaced hope, as it would later turn out. Foscarini sent a copy of his work to Bellarmine, asking for his views on the subject. The latter replied graciously in a letter that has been subject to much analysis and disagreement (as we shall see below), giving as his opinion that he knew of no "true demonstration that the sun is at the centre of the world...", and further that he would

Quote

... not believe that there is such a demonstration, until it is shown me. Nor is it the same to demonstrate that by supposing the sun to be at the centre and the earth in heaven one can save the appearances, and to demonstrate that in truth the sun is at the centre and the earth in heaven; for I believe the first demonstration may be available, but I have very great doubts about the second, and in case of doubt one must not abandon the Holy Scriptures as interpreted by the Holy Fathers. (XII, 171-172)

Leaving aside for now the question of how Bellarmine's position as described in the complete letter to Foscarini should be understood, we may note that reference was made to the philosophical concept of saving the appearances, or astronomical instrumentalism. This was the widespread (although some scholars have disagreed: cf. Musgrave, 1991) notion that astronomers were not concerned with giving a true description of the heavens but only a model that would fit the observations (hence "saving the appearances") and provide an instrument of prediction. To assert that Copernicanism saved the appearances better than the Ptolemaic or Tychonic systems, then, was only to say that it gave more accurate predictions or fitted the available data more simply. (A preface written by Andreas Osiander, a Lutheran theologian, was inserted into De revolutionibus orbium celestium for just this reason.) Bellarmine, like most of his contemporaries, had no complaint at instrumental claims for the superiority of the Copernican system, but considered that it would be a grave error to conclude that it represented the truth about what was in the heavens.

To respond to this and the other criticisms he had faced since the circulation of his letter to Castelli, Galileo re-wrote and expanded it substantially, addressing it as a Letter to the Grand Duchess Christina (V, 309-386). In this famous work, Galileo set out his aims and motivations; namely, to separate science from religion and to save the Church from falling into the error advised against by Augustine centuries before ("... we do not read in the Gospel that the Lord said: I will send you the Paraclete to teach you how the Sun and the Moon move. Because he wished to make them Christians, not mathematicians." (De Actis cum Felice Manichaeo, I, 2)). This second
point was to note that since a heretic might know more astronomy than a Christian, it would be foolish to fix the truth via the Scriptures lest an infidel show them to be in error. We shall look at both these ideas in more detail.

Realising that his opponents, unable to debate him on scientific grounds, wanted to fight him behind the shield of Scripture, one of the first tasks Galileo set himself in the letter was to call attention to the precedent for non-literal interpretations of Biblical passages:

**Quote**

.... the Scripture appears to be not only full of contradictions and false propositions but also of serious heresies and blasphemies; for one would have to attribute to God feet, hands, eyes, and bodily sensations, as well as human feelings like anger, contrition, and hatred, and such conditions as the forgetfulness of things past and the ignorance of future ones. Since these propositions dictated by the Holy Spirit were expressed by the sacred writers in such a way as to accommodate the capacities of the very unrefined and undisciplined masses, for those who deserve to rise above the common people it is therefore necessary that wise interpreters formulate the true meaning and indicate the specific reasons why it is expressed by such words. This doctrine is so commonplace that it would be superfluous to present and testimony for it. *(op cit)*

Faced with a Biblical statement that appeared to make no sense, then, the Fathers of the Church would try to discover the correct, non-literal interpretation of it. They were bound to do so since the Bible, being the Word of God, could not err. Galileo did little more than conclude "that in disputes about natural phenomena one must begin not with the authority of Scriptural passages but with sensory experience and necessary demonstrations" *(op cit)*. Going further, Galileo wrote that
... some physical propositions are of a type such that by any human speculation and reasoning one can only attain a probable opinion and a verisimilar conjecture about them, rather than a certain and demonstrated science; an example is whether the stars are animate. Others are of a type such that either one has, or one may firmly believe that it is possible to have, complete certainty on the basis of experiments, long observations, and necessary demonstrations; examples are whether or not the earth and sun move and whether or not the earth is spherical. As for the first type I have no doubt at all that, where human reason cannot reach, and where consequently one cannot have a science, but only opinion and faith, it is appropriate piously to conform absolutely to the literal meaning of Scripture. In regard to the second type of propositions, however, I should think, as stated above, that it would be proper to ascertain the facts first, so that they could guide us in finding the true meaning of Scripture; this would be found to agree absolutely with demonstrated facts, even though prima facie the words would sound otherwise, since two truths can never contradict each other. (op cit)

Here Galileo was hoping to establish the separation of science and religion: where there is no way to establish by science the truth or otherwise of a theory, it is proper to resort to a literal reading of the relevant Biblical opinions; but where science can be used, we should interpret the Scripture in light of what science tells us can or cannot be so. In the case of Copernicanism, specifically, Galileo's discoveries should be employed to help understand what the problematic Biblical passages actually entail. To insist that the literal meaning should be adhered to when scientific investigation shows otherwise is to fall into error, since there cannot be two conflicting truths.

A possible rejoinder to Galileo's arguments here was made both then by Bellarmine in the excerpt quoted above and more recently by Galileo scholars; namely, that Galileo did not have anything approaching "complete certainty" with regard to the Copernican hypothesis. He quite clearly stated, however, that where "one may firmly believe that it is possible to have" scientific justification to the contrary of a literal reading, we should defer to science and allow it to guide our interpretation. In more modern parlance, perhaps, we might say that where it is possible in principle that a literal Scriptural passage may be contradicted by scientific investigation, we should be careful in attributing the same. This is the approach taken by the Church today.

Commenting on the fact that the Pope had the power to condemn any opinion at any time as heretical, Galileo explained another aspect to the separation of science and religion. It was, he said,

... advisable to first become sure about the necessary and immutable truth of the matter, over which one has no control, than to condemn one side when such certainty is lacking; this would imply a loss of freedom of decision and choice insofar as it would give necessity to things which are presently indifferent, free, and dependent on the will of supreme authority. In short, if it is inconceivable that a proposition should be declared heretical when one thinks it may be true, it should be futile for someone to try to bring about the condemnation of the earth's motion and the sun's rest unless he first shows it to be impossible and false. (ibid)

The principle invoked here is one holding that since no one (from the Pope to a layman) would consider heretical a statement that could in fact be true, they could similarly not declare Copernicanism heretical unless they have already demonstrated its impossibility. In conjunction with the earlier remarks, we have a separation that allows science to pursue any matter that we have reason to believe may be resolved by investigation, a pursuit that may not be hindered by an apparent conflict with Scripture because Biblical passages are not always interpreted
literally and cannot speak definitively of heresy unless the scientific question has been shown to be false. What this did, of course, was to place Scripture as the final authority, not the first or pre-eminent one—a move that would incite his enemies yet again.

The impact of the Letter at the time was minimal, since it circulated solely within Galileo's circle of friends and was not published until late in his life. We can see, though, that when Galileo protested that he had "no other aim but the honour of the Holy Church" (ibid), he was seeking to separate science and religion in order that the Church not come to dishonour by fixing on interpretations of Scripture that could later be shown false. This in turn would raise the possibility that the Church could be left behind by science, perhaps rendering it irrelevant or at least suggesting to those so inclined that if it was in error in one area then why not another? This is an important point to realise: Galileo was a devout Catholic and there is no question he sought to save his Church, not to criticise or call it into question.

The Arguments Against Galileo (1)

While Galileo was at work on the Letter, Caccini was in front of the Holy Office in March of 1615, testifying on his own initiative in support of his allegation that Galileo was holding opinions "repugnant to the Divine Scripture" (IX, 308-309). Caccini remarked that Galileo was "suspected in matter of Faith" by others and in correspondence with Germans (i.e. Protestants) by virtue of his membership of the Accademia dei Lincei (ibid). Ultimately, all of Caccini's accusations were dismissed, with the exception of one concerning Galileo's Copernicanism. In November of that year, an order was given that his Letters on the sunspots should be examined (IX, 278).

Understandably concerned by this latest attack by his opponents, Galileo resolved to journey to Rome to make his case in person, "in the hope of at least showing [his] affection for the Holy Church" (XI, 184). In particular, he was opposed to any declaration that Copernicus had himself merely hoped to save the appearances, rather than believing that the Earth truly moves (ibid). His problems were exacerbated, however, by Foscarini's book and the conservative backlash it had engendered in at atmosphere already tense because of Galileo's writings. He requested and was granted permission to travel to Rome "to defend himself against the accusations of his rivals", as the Grand Duke wrote to his ambassador (XI, 203).

Arriving on the 10th of December, 1615, Galileo was determined to defend himself from the suggestion that he was a secret heretic, when—as we have seen—he thought himself a devout Catholic, dedicated to his Church. He embarked on an intense period of letter writing and visits, gradually realising the depth of feeling against him in some quarters. This was due, in no small part, to a tendency he had in debate that was explained by Antonio Querengo in a letter to Cardinal d'Este in January:

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What I enjoyed most was that before he would answer the arguments of his opponents, he would amplify them and strengthen them with new grounds which made them appear invincible, so that, when he proceeded to demolish them, he made his opponents look all the more ridiculous. (XI, 226-227)

This was by no means an isolated instance of the power (and effect) of Galileo's rhetoric, as we shall see in more detail below. Nevertheless, his activity and Foscarini's work had forced the Church to look at the matter in more detail and so two propositions were submitted for the consideration of the qualifiers of the Holy Office:
1. The Sun is the centre of the world and hence immovable of local motion.
2. The Earth is not the centre of the world, nor immovable, but moves according to the whole of itself, also with a diurnal motion. (XIX, 320)

These were examined by theologians, not scientists or those skilled in scientific areas. This, of course, was Galileo's complaint against his adversaries to begin with—that they did not know enough about the ideas they presumed to dismiss. In spite of this handicap, a decision was reached within four days. The Tuscan Ambassador, Piero Guicciardini, attributed this to the fact that "Galileo has monks and who hate and persecute him" (XII, 242), asserting that "certain friars of St. Dominic, who play a major role in the Holy Office, and others are ill disposed toward him" (XII, 207). Guicciardini had already warned that nothing good could come of the trip and had strongly advised against it (ibid).

On the 23rd of February, 1616, the opinion of the qualificators was agreed and presented the next day in the plenary session of the consultors of the Holy Office. On the first proposition, the qualification was that

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**Quote**

All said that this proposition is foolish and absurd in philosophy, and formally heretical since it explicitly contradicts in many places the sense of Holy Scripture, according to the literal meaning of the words and according to the common interpretation and understanding of the Holy Fathers and the doctors of theology. (XIX, 321)

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For the second, the decision was that

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**Quote**

All said that this proposition receives the same censure in philosophy and that in regard to theological truth it is at least erroneous in faith. (ibid)

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It is important to appreciate fully what the key terms in these qualifications meant. "Formally heretical" implies that the first proposition was diametrically opposed to a doctrine of faith; that is, the opinion of the plenary session was that the words of the Holy Fathers and the literal interpretation of the Scriptures were to be understood as a statement of faith. (Note that this is precisely the position Galileo had warned of and tried to have his Church avoid, and Augustine before him—that of allowing faith to dictate a physical truth.) This charge was the most serious possible. "Erroneous in faith", however, is a lesser complaint, according to which the Scriptures do not give a clear indication on the issue but, given the falsity of the first proposition, it would be an error to suppose that the Earth moves when it had already been declared a matter of faith that the Sun circles the Earth. As for "foolish and absurd in philosophy", note that theologians were pronouncing a physical theory philosophically unsound. We have already seen, from Guicciardini's letters, why these men should have taken such a short period of time (four days) to decide a question entirely beyond their ken on the basis of Scripture. Neither physical nor philosophical arguments were given.

On the next day, in the weekly meeting of Cardinals, Millini notified those present that "after the reporting of the judgement by the Father Theologians against the propositions of the mathematician Galileo, to the effect that the sun stands still at the centre of the world and the earth moves even with the diurnal motion, His Holiness ordered the Most Illustrious Cardinal Bellarmine to call Galileo before himself and warn him to abandon these opinions; and if he should refuse to obey, the Father Commissary, in the presence of notary and witnesses, is to issue him
an injunction to abstain completely from teaching or defending this doctrine and opinion or from discussing it; and further, if he should not acquiesce, he is to be imprisoned" (XI, 321). Although this may seem harsh, it expresses a careful degree of tact: the two propositions had been condemned, not Galileo, and the Church sought a way to entreat him to give up his ideas without embarrassing the Grand Duke (of whose court Galileo was an official part) or Rome (on account of Galileo's fame throughout Europe). Fantoli (1996: 259) remarks that neither Paul V nor Bellarmine bore Galileo any ill will, the former evidenced by the audience that he was granted with the Pope shortly thereafter.

We shall discuss the physical and other arguments against the two propositions below but there was also a specific objection to Galileo's ideas that worried the Church. In his letter of advice to Galileo sent via Ciampoli, already quoted from above, Cardinal Barberini explained:

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Your opinion regarding the phenomena of light and shadow in the bright and dark parts of the moon draws an analogy between the lunar globe and the Earth. Somebody then enlarges on this, and says that you place inhabitants on the Moon. The next fellow starts to dispute how these can be descended from Adam, or how they can have come off Noah's ark, and many other extravagances you never dreamed of" (op cit).

Barberini's solution to this difficulty was to "declare frequently that one places oneself under the authority of those who have jurisdiction over the minds of people in the interpretation of Scripture is to remove this pretext for malice" (op cit). The problem suggested here was a very real one, however: for some people it was a short step from displacing the Earth from the centre of the world to it being just another planet like any other, some of which might contain life. This would be far more than allowing that the Earth moves, extending to the possibility that people might live elsewhere in the universe and raising all kinds of theological questions: would these people have known the revelation of Christ? How could they be saved if it were otherwise? Had they then received the Scriptures? How? If Christ had ascended to heaven following His resurrection, when did he visit these other worlds? The redemption was supposed to be a unique event, and so on. For the farsighted clergy, Copernicanism was not just a matter of the moving Earth, and Barberini's warning was that Galileo's enemies could take advantage of his silence on these issues to assert that he would imply them all unless stopped. A good example of the concerns was given by Brecht's simplistic rendering of the affair in his play:

Quote

I am informed that Signor Galilei transfers mankind from the centre of the universe to somewhere on the outskirts. Signor Galilei is therefore an enemy of mankind and must be dealt with as such. Is it conceivable that God would trust this most precious fruit of His labour to a minor frolicking star? Would He have sent His Son to such a place? ... [To Galileo] You have degraded the earth despite the fact that you live by her and receive everything from her. I won't have it! I won't have it! I won't be a nobody on an inconsequential star briefly twirling hither and thither... The earth is the centre of all things, and I am the centre of the earth, and the eye of the Creator is upon me. About me revolve, affixed to their crystal shells, the lesser lights of the stars and the great light of the sun, created to give light on me that God might see me—Man, God's greatest effort, the centre of creation: "In the image of God He created him." (op cit, 72-73)

For some, the case of Giordano Bruno was still fresh in their minds. Bellarmine, in particular, had worked as a consultor on it before his election as Cardinal. Basing his ideas on Copernicus' heliocentrism, as well as Neo-
Platonism, Bruno held that the universe was infinite (something Copernicus had refused to countenance—cf. Book I, Chapter VIII of *De revolutionibus orbium celestium*) with a correspondingly infinite number of systems like our own, drawing the obvious conclusion that beings similar to us probably lived on some of these and bringing to bear all the above questions. Accused of heresy, Bruno was tried by the Holy Office and, although none of the charges were proven and he was repeatedly denied his legal right to appeal all questions of heresy to the Pope (cf. Fantoli, 1994: 43 and Drake, 2001: 26), he was publicly burned at the stake in 1600.

**Galileo and Patronage**

Galileo was not treated in a similar fashion at this stage, however. In accordance with the order quoted above and his position both as the pre-eminent intellectual in Europe and as a member of the Tuscan Court, he visited Bellarmine and was given a private injunction. Exactly what happened at this meeting has been subject to much discussion and scrutiny, particularly given its import at Galileo's later trial. We shall return to it below.

On the 5th of March, the Congregation of the Index published its decree announcing the prohibition of certain works. After describing the intent of the "Pythagorean doctrine", it declared that

> ... in order that this opinion may not insinuate itself any further to the prejudice of the Catholic truth, the Holy Congregation decreed that the said Nicolaus Copernicus, *De revolutionibus orbium celestium*, and Diego de Zu iga, *On Job*, be suspended until they be corrected; but that the book of the Carmelite Father, Paolo Antonio Foscarini, be altogether prohibited and condemned, and all other works likewise, in which the same is taught, be prohibited, as by this present decree it prohibits, condemns and suspends them all respectively. (XIX, 323)

We need not be apologists to note that the contemporary era lacks any moral high ground from which to lament the banning of books (cf. Martin, 1954), which is the exclusive domain of neither religion nor medieval contexts. Moreover, it is known that only eight percent of copies of Copernicus' work were ever censored (Gingerich, 1981: 45-61), the decree being difficult to enforce. Nevertheless, for our purposes the important point on which to remark is that there was no mention of *heresy* in the decree of the Index, nor Galileo. Although Foscarini's book was to be banned entirely, Copernicus' and Zu iga's merely required minor corrections. This was due, it seems, to Foscarini's work being devoted to showing the compatibility of Copernicanism with Scripture, while the others only mentioned it in passing.

The obvious questions to ask, then, are why, if Galileo's expositions of the first proposition were judged to be "formally heretical", was he not mentioned by name, and why was there no suggestion that the decree was due to the heretical nature of the works? The answers may be found in a diary entry of Gianfrancesco Buonamici, recalling these events many years later:

> In the time of Paul V this opinion [i.e. the two propositions] was opposed as erroneous and contrary to many passages of Sacred Scripture; therefore, Paul V was of the opinion to declare it contrary to the Faith; but through the opposition of the Lord Cardinals Bonifatio Gaetano and Maffeo Barberini, today [i.e. in 1633] Urban VIII, the Pope was stopped right at the beginning on account of the good reasons taken by their Eminences and the learned writings of the said Mr. Galileo on this matter addressed to Lady Christina of Tuscany about the year 1614. (XV, 11)
The reference to Galileo's *Letter* was described by Fantoli (1996, 262) as "completely unlikely", since it was not published at that time (1616) and hence not available to the Pope in his deliberations. Nevertheless, we see here an important factor in the Galileo affair that has been noted by many scholars (in particular, Biagioli, 1993); namely, the relevance (or even decisive influence) of *patronage*. This was (and in some places still is) a social dimension that was impossible to avoid (indeed, Biagioli remarks that it was "a voluntary activity only in the narrow sense that by not engaging in it one would commit social suicide" (1993: 16). Not only was the social status of an author correlated with the credibility of their ideas and, in particular, their reports of observation and experiment (cf. Shapin, 1985 (with Schafer) and 1995, and Dear, 1985), just as today, but also individual disciplines were accorded a place in a hierarchy, theology, as queen, at the top. The rigidity of this particular structure is one of the reasons why Galileo's challenge was so unwelcome. Indeed, already in the 1540s Tolosani had written a critique of Copernicus from this perspective, stating that the "lower science receives principles provided by the superior" and that the latter had violated this order by neglecting to ascribe to mathematics and astronomy their proper places (quoted in Garin, 1975: 31-42).

![Cosimo ll de' Medici, Grand Duke of Tuscany](image)

As we have seen, Galileo's early career depended on the patronage of men like Guidobaldo and Clavius. Aside from his obvious talents, he relied on the patronage connections already established by his father, Vincenzio (Biagioli, *op cit* 22). At this stage Galileo was not able to contact the Grand Duke directly, having to negotiate his way via satellite personalities that functioned as brokers. An example of the manner of writing and speech that was required to navigate the system of patronage is given by his first letter written *directly* to Cosimo in 1605, his former student with whom he had cultivated the client/patron relationship for several years:

**Quote**

I have waited until now to write to Your Most Serene Highness, being held back by a respectful concern of not wanting to present myself as presumptuous or arrogant. In fact, I made sure to send you the necessary signs of reverence through my closest friends and patrons, because I did not think it appropriate ... to appear at once in front of you and stare in the eyes of the most serene light of the rising sun without having reassured and fortified myself with their secondary and reflected rays. (X, 153-154)

It is important to place Galileo and the entire Galileo affair *within* this context of patronage. The system functioned in two directions: on the one hand, the client hoped to use his patrons to secure social advance and economic
success; on the other, the patron intended his clients to shower him in reflected glory, as it were—a testament to his enlightened court and his wide ranging interests. "A patron demonstrated his magnificence by supporting the best." (Westfall, 1989: 65) The image of early science as a *venatio* or "hunt" beyond the realm of mere appearances was a product of the courts, "develop[ing] outside of the universities" and "*in opposition to* the methodological assumptions of official academic culture" (Eamon, 1991: 74). Courts at this time were a magnet for all types of new ideas and Galileo was not the only one seeking to make a name and find a place for himself, Machiavelli having declared that "a prince ought to show himself a lover of ability, giving employment to able men and honouring those who excel in a particular field", thereby gaining "the reputation of being a great man of outstanding ability". Many Renaissance courts kept *wunderkammern* to house and publicly display curiosities, thereby demonstrating the power of the prince and the extent of his dominion, even unto the weird and wonderful. The de' Medici's kept a *studioli* in like fashion, Francesco I eventually transferring most of the contents of his to the *Uffizi* gallery in 1584. Perhaps the most famous example of patronage and its import is the court of Rudolf II in Prague and its *Kunstkammer*, a part of his attempt to establish himself as a contemporary Maecenas, acting as a patron to Brahe and Kepler, amongst others.

Intermediaries were used because patrons did not want to take the risk associated with direct communication or offering support to a client who might subsequently embarrass them. Having invested many years in his association with Cosimo, Galileo was able to use his telescopic discoveries to finally give himself the importance he felt he had, although prior to that time he had little value to the court. "Without these carefully forged relationships, the Medicean Stars would not have projected him into prominence" (Biagioli. *ibid* 24). A network of brokers supported this system and it is easy to see parallels in some aspects of contemporary society.

The ritualised conduct inherent in the patronage system was not an archaic irrelevancy that Galileo had to struggle against, then, but one in which he fully immersed himself *as he had to*. This was vital because the hierarchical status of Galileo's discipline (mathematics) and his methodology was so low in comparison with others (cf. Westman, 1980 and Biagioli, 1989). In order to improve its *epistemological* standing, it was first necessary for Galileo to gain in *social* standing; and the only way to do that was to seek out a patron—the higher in society the better. As a consequence, we have to appreciate that Galileo's social activities were not *ancillary* to his scientific work but an unavoidable and interdependent part of it: the more he gained in importance by his association with patrons, the more his ideas gained a hearing; while, conversely, the more famous he became from his scientific work, the more desirable he was as a client to patrons of increasing prestige and influence. Inevitably, of course, Galileo would come into conflict with others seeking patronage in much the same way, whether those seeking similar positions or those resentful of the proposed reordering of the disciplines that he was working towards. Then, as now, fame and reward brought with them jealousy and envy.

To return to our story, an obvious question to ask is why the Church—if it was indeed opposed to Galileo's ideas and to science in general—allowed him to publish *at all*, either up to 1616 or later? As we have seen, his position in the court of the Grand Duke of Tuscany was in no small part responsible for the private injunction he received from Bellarmine and his absence from the decree of the Index, along with the relatively minor role of the asides on Copernicanism in his writings to that date. The letter from Buonamici, quoted above, together with one from the much later Tuscan Ambassador Francesco Niccolini (XIV, 428), both spoke of Maffeo Barberini having "preserved" Galileo (cf. also Westfall, 1989: 21). Speaking directly of his intervention, Barberini remarked in 1630 that prohibiting Copernicanism "was never our intention, and if he had been left to us, that decree would not have been made" (XIV, 88). If Galileo's patrons had saved him, however, others were suggesting that he was himself unintentionally doing all he could to ruin his good fortune.

*Galileo and Rhetoric*
When he wrote to Tuscan court to inform them of the outcome of the events of early 1616, Ambassador Giucciardini explained what he held to be Galileo's significant part:

> Galileo has relied more on his own counsel than on that of his friends. Cardinal del Monte and myself, and also several Cardinals from the Holy Office, tried to persuade him to be quiet and not to go on irritating the issue. If he wanted to hold this Copernican opinion, let him hold it quietly and not to go on irritating the issue. If he wanted to hold this Copernican opinion, he was told, let him hold it quietly and not spend so much effort in trying to have others share it. Everyone feared that his coming here might be prejudicial and dangerous and that, instead of justifying himself and triumphing over his enemies, he could end up with an affront. (XII, 241-242)

He went on to add that Galileo was...

> ... all afire on his opinions, and puts great passion in them, and not enough strength and prudence in controlling it [sic]; so that the Roman climate is getting very dangerous for him... (ibid)

It is this kind of description of Galileo as a Copernican zealot, utterly convinced of the truth of his ideas and determined to spread them, that forms the basis of the second myth of the Galileo affair (cf. Duhem, 1969; Koestler, 1959; Feyerabend, 1993; Langford, 1966; Shea and Artigas, 2003). Giucciardini was not alone in his view of events, with even Kepler blaming the prohibition of part of his own 1618 work *Epitome Astronomiae Copernicanae* on the "inappropriateness of some who have treated of astronomical truths in places where they should not be treated and with improper methods" (V, 633).

This thesis, however, overlooks several important points that—at this stage, at any rate—give the lie to it. Guicciardini did not know the content of Bellarmine's injunction to Galileo, sending his report to the Grand Duke before the adoption of the decree of the Index and incorrectly asserting that Galileo's opinion had been found "erroneous and heretical" (op cit). He spoke, therefore, only of "rumours that were circulating among the circles of the Papal Curia" (Fantoli, 1996: 258). More importantly, perhaps, and in spite of the Ambassador's insistence that the Pope would not tolerate such things, Galileo was granted an audience with the Pontiff less than two weeks later. According to Galileo's testimony,

> ... since I appeared somewhat insecure because of the thought that I would always be persecuted by their [i.e. his enemies'] implacable malice, he consoled me by saying that I could live with my mind at peace, for I was so regarded by His Holiness and the whole Congregation that they would not easily listen to the slanderers, and that I could feel safe as long as he lived. (XII, 248)

Galileo did not return immediately to Tuscany with this assurance, since he heard from several of his friends (for instance, XII, 246) that rumours were circulating to the effect that he had been ordered by Bellarmine to adjure his heresy. Having complained to the latter in this connexion, Galileo received on May the 26th a signed statement from the Cardinal describing what had occurred at their meeting (XIX, 348). (This document would prove important
for his later trial and all subsequent scholarship, and we shall return to it later.) Although his attempt to separate
science and religion had failed for the time being, Galileo was content to travel back to Florence and wait for a
more opportune moment. In spite of the judgement of the theologians, the Church had not condemned
Copernicanism but only mandated that it be treated as a hypothesis.

In the meantime, Galileo returned to his studies and observations, working on his *Discourse on the ebb and flow
of the sea* and the eclipses of the satellites of Jupiter. This latter endeavour was being used to compile tables that
Galileo believed could help address the problem of determining longitude at sea, a famous problem for navigators
(cf. V, 419-425). Negotiations had been opened with the Spanish King to this end, although they would eventually
(in 1632) grind to a halt.

*Christoph Scheiner, Galileo’s Jesuit opponent on the question of sunspots*

Late in 1618, three comets were seen in quick succession, beginning another round of speculation on their
implications—whether for astronomical systems or as harbingers of upheavals to come. Galileo was unable to
offer any comment himself due to illness (a susceptibility to which had plagued him throughout his life and would
continue to do so), later stating so explicitly (VI, 225), and refused to rely on guesswork when he had made no
observations of his own.

Nevertheless, the Jesuits were not so constrained and in 1619 their professor of mathematics at the Roman
College, Orazio Grassi, who would later take over from Grienberger, wrote *De tribus cometis anni MDCXVIII
disputatio astronomica* (“An astronomical discussion on the three comets of 1618”), otherwise known as the
Disputatio. Although released under a pseudonym, much like Scheiner’s booklet, Grassi defended the Tychonian
system and word reached Galileo that “the Jesuits have spread it around that this thing overthrows the
Copernican system, against which there is no surer argument than this” (XII, 443—although Biagioli claimed that
this is a mistranslation (1993: 282, n49) and, more accurately, states that some outside the Jesuit order were
spreading the rumour).

This tactic of composing texts without giving a real name was part of the precautions used in the patronage
system, according to Biagioli (1993: 63): to avoid tarnishing the image of his order or patron, an author would not
give his name. Galileo quickly found out, however, and took exception—wrongly (Fantoli, 1996: 303)—to a remark
he felt was directed at him. Replying through his friend and former student, Mario Guidicci (although it is known
that Galileo wrote almost the entirety of the work attributed to Guidicci (XII, 457)), Galileo and his friends were
thereby responsible for the rapid destruction of his good relations with the Jesuits, the consequences of which
cconcerned Ciampoli who said that the Jesuits were "much offended" (XII, 466). It was too late, however, as
Grienberger observed:
So began the cycle that demonstrates Galileo's brutal rhetoric and its effects decisively. A master of satire and wit, possessed of the sharpest of tongues, Galileo opened the *Discourse on the comets* by explicitly accusing Scheiner of plagiarism during their earlier interaction on the subject of sunspots, a charge "deliberately couched in the most insulting terms" (Westfall, 1989: 51), before moving on to "rip Grassi apart" (*ibid*). In spite of some scholars incorrectly portraying Galileo's arguments as "decadent Aristotelianism" (Shea, 1972: 85) when they could not be reconciled with Aristotle (Fantoli, 1996: 278), or the barely disguised glee at the "demythologiz[ing of] the heroes of the scientific revolution" (Shea, 2003: 100), he had shown the inability of the Tychonic system to account for the observations of the comets rather than attempted to replace it—that is, to show that the purported refutation of Copernicanism was no such thing. Grassi's response was not long in coming, published as the *Libra astronomica ac philosophica* also in 1619 but under a different pseudonym, "Sarsi", allegedly a disciple of Grassi and keen to show him in a better light. This reply was also not free of rhetoric but nothing on the scale that Galileo would unleash in his rejoinder.

While the Jesuits were speaking of having "annihilated" Galileo (XII, 498-499), he himself was cautiously composing what would become The Assayer. Since his patron Cosimo II had died, along with Paul V earlier in 1621, he was keen to avoid controversy at home. As time passed, his friends became increasingly concerned that silence on his part was as good as admitting defeat, although—as usual—Galileo had again been very ill. He eventually completed the work in 1622 and his friends Cesi and Cesarini set about obtaining permission for its publication in Rome by the *Accademia dei Lincei*, some its members suggesting slight modifications. Examined and accepted by the Dominican Niccol Riccardi, the manuscript was with the printers in 1623 when the new Pope, Gregory XV, died suddenly only two years into his tenure. After much argument among the Cardinals, Maffeo Barberini, Galileo's friend and great defender, was elected to the Pontificate, taking the name Urban VIII. Galileo immediately wrote to Cesi of this *mirabil conjiuntura* ("marvellous conjuncture"), saying that if they could not achieve their aims now then "they will never come about because—as far as I am concerned—there is no point hoping that a similar situation will come around again" (XIII, 135).
Galileo had good reason to continue to delight in this fortuitous occasion: his friends Cesarini and Ciampoli were appointed as Master of the Chambers and Secretary of the Briefs to the Princes respectively—both already members of the Accademia dei Lincei. To take advantage of the circumstances, the Accademia decided to dedicate the Assayer to the new Pontiff (XIII, 129). Thus was born a work that has been described as "a stupendous masterpiece of polemical literature" (Geymonat, 1965: 101), in which Galileo's command of rhetoric was given free reign. Having told Colombe previously that "there is no point in undertaking to refute someone who is so ignorant that it would require a huge volume to refute his stupidities (which number more than the lines of his essay)" (IV, 443), he was simply brutal to Grassi and his appeals to the authority of others:

**Quote**

If Sarsi [i.e. Grassi] insists that I must believe ... that the Babylonians cooked eggs by swiftly whirling them in a sling, I will believe it; but I must say that the cause of such an effect is very remote from that to which it is attributed, and to find the true cause I shall reason thus. If an effect does not follow which followed with others at another time, it is because, in our experiment, something is wanting which was the cause of the former success; and if only one thing is wanting to us, that one thing is the true cause. Now we have eggs, and slings, and strong men to whirl them, and yet they will not become cooked; nay, if they were hot at first, they more quickly become cold; and, since nothing is wanting to us but Babylonians, it follows that being Babylonians is the true cause why the eggs became cooked, and not the friction of the air, which is what I wish to prove. ... I, at least, will not be so wilfully wrong, and so ungrateful to Nature and to God, that, having been gifted with sense and logic, I should voluntarily set less value on such great endowments than on the fallacies of a fellow-man and blindly and blunderingly believe whatever I hear and barter the freedom of my intellect for slavery to one as liable to error as myself. (quoted by de Santillana, 1958: 158)

In another famous passage, he expressed his contempt for those who attacked him:

**Quote**

Perhaps Sarsi believes that all the host of good philosophers may be enclosed within four walls. I believe that they fly, and that they fly alone, like eagles, and not in flocks like starlings. It is true that because eagles are rare birds
they are little seen and less heard, while birds that fly like starlings fill the sky with shrieks and cries, and wherever they settle befoul the earth beneath them... The crowd of fools who know nothing, Sarsi, is infinite. Those who know very little part of philosophy are numerous. Few indeed are they who really know some part of it... (from Drake, 1957: 239)

Little wonder, then, that Galileo aroused such vehement opposition in his enemies through a combination of a gargantuan ego and ruthless tongue. As Westfall remarked, "[n]ot even a saint would have received Il Saggiatore without hostility, and Grassi has not been nominated for sainthood" (1989: 51). Nevertheless, Galileo was caught up in the patronage system and ignoring Grassi and others was not an option: defeat would reflect on his patrons as surely as his successes and there were continual calls for "some further new invention of [his] genius" (XIII, 146-147). In spite of the risks, then, Galileo had to "publish or perish"; showing, once more, that it is simply not possible to break up the Galileo affair into distinct spheres of influence. Galileo's ego and his rhetoric, as well as his patronage and his successes, won him many adversaries; but to maintain the latter pair he had to continually demonstrate the former (Biagioli, 1993: 277), and so it is easy to conclude that they would eventually (and inevitably) bring about his downfall (cf. Biagioli, in toto, op cit).
As we shall see, the Assayer was not just a polemic, in spite of the declarations to that effect on the part of several writers on Galileo (cf. de Santillana, 1958; Geymonat, op cit). Commenting on the fact that the myriad areas touched upon and arguments used have confused some scholars, Biagioli became befuddled himself when he referred to so-called Feyerabendian opportunism as an explanation for Galileo's employment of "ad hoc hypotheses, internal contradictions, and unjustified attacks" (1993: 268). Preferring to see Galileo’s response within the context of patronage and as an attempt to reinforce his belief that he, and not Brah, was the pre-eminent post-Copernican astronomer, Biagioli failed to consider the possibility that Galileo was employing a reductio, a far more accurate "Feyerabendian" reading of the problematic existence of inconsistencies (cf. Farrell, 2003: 12-17 and further). This is part of a general trend among Galileo scholars that praises him for his genius as a rhetorician at one moment and ignores the most potent tool in any polemic the next in seeking to explain why the text does not form a cogent whole. Drake, at least, had noticed this (1999, 1: 30).

Before moving on to consider the other aspects of the Assayer, it is illuminating to compare Galileo’s situation at this time—and hence—with that of John Wilkins in England. A vociferous defender of Copernicanism, he faced little opposition and was able to publish his Discovery of a world in the moon (1638) and Discourse concerning a new planet (1640) with ease. Although his career as an academic was put at risk by his alleged sympathies with the Royalist cause, his "survival as warden of Wadham [the Oxford College], his move to the mastership of Trinity College Cambridge in 1659, his becoming bishop of Chester in 1668, and his appointment as Lent preacher to the king suggest that there was nothing particularly hazardous in being England's most conspicuous Copernican" (Brooke, 1991: 107-108). To explain the Galileo affair simplistically as an instance of the supposed conflict between science and religion, then, is to invite the question as to why the reaction to Copernicanism differed between countries that were all religious (cf. Russell, 1991: 83-88).

**Intellectual Contexts**

Galileo's work and the criticism it faced were not just rhetoric, politics and patronage. In this second section we shall look at Galileo's science and its development, along with the philosophical aspects to the affair. In particular, we shall look again at the objections raised against his ideas.

**Galileo and Science**

Many pages have been authored on the subject of Galileo's scientific personality, a significant proportion of them concerned with "de-mythologising" Galileo and the view within the history of science that science proceeded (and proceeds) according to leaps of genius by greats like Galileo, Newton or Einstein. Some historians, however, have gone so far as to attribute to Galileo the character of a Copernican zealot who went far beyond reasonable scientific behaviour in seeking to convince others to accept conclusions for which there were insufficient grounds (for example, Koestler, 1959; Feyerabend, 1993; Shea and Artigas, 2003). This is the second myth we began with.
As we have noted above, Galileo regularly declined to publish his ideas when he felt they needed more work, whether his theories on motion or Copernicanism. He had preferred the second since the late 1590s but, lacking the telescopic observations that would show the Ptolemaic system to be false, he did not publicly support it until 1610. During his student days Galileo had rejected Copernicanism, setting out his reasons for so doing (Wallace, 1977: 71-74). Later, in a letter of 1597 to Kepler, he had written that

**Quote**

... I have already for many years come to accept the Copernican opinion and with this hypothesis have been able to explain many natural phenomena, which under the current hypotheses remain unexplainable. (X, 68—emphasis added)

Until his telescopic observations of the phases of Venus in late 1610, Galileo had no conclusive proof of the falsity of the Ptolemaic system, although he had come to believe the reality of the Copernican system. This is quite in accordance with a gradual development in both his thought and arguments (a full account of which was given by Drake (1999, 1: 351-363)) and the general principle he would later famously state in the following terms:

**Quote**

There is not a single effect in Nature, not even the least that exists, such that the most ingenious theorists can ever arrive at a complete understanding of it. This vain presumption of understanding everything can have no other basis than never understanding anything. For anyone who had experienced just once the perfect understanding of one single thing, and had truly tasted how knowledge is attained, would recognise that of the infinity of other truths he understands nothing. (Drake, 1953: 101)

In spite of passages like this and the principles enunciated in the *Letter to Christina*, some Galileo scholars have insisted that he was a convinced Copernican who was determined to battle dishonestly for a doctrine he knew to be unproven and for which he had no proof. When we understand these issues from the perspective of his wish to bring about the separation of science and religion, however, there are no such problematic excerpts to explain away as deliberately disingenuous or still more rhetoric: the telescope had sounded the death-knell for both the Ptolemaic and Tychonic systems and, even if this did not imply the truth of the Copernican alternative, it at least
showed that the wedding of astronomical fact to Scriptural exegesis could not be maintained.

Much has been made of Galileo's writing in Italian, rather than the Latin then employed by most philosophers, theologians and the like. According to Feyerabend (1993), this was a rhetorical strategy on the part of Galileo, helping him to bypass the theologians and scholastics and appeal directly to the public; but it is hard to see how common opinion could have aided a zealous Copernican, even one of Galileo's stature, in swaying the decisions of the authoritarian Church. A far simpler explanation was given by Galileo himself in a letter of 1612:

**Quote**

What inspires me to do this [i.e. use Italian—or, more accurately, the Tuscan dialect] is my seeing how students in the universities, sent indiscriminately to become doctors, philosophers, etc., apply themselves in many cases to such professions when unsuited to them, while others who would be apt are occupied with family cares or with other pursuits remote from literature. Though well provided with horse sense, as Ruzzante would say, such men, being unable to read things written in Latin, become convinced that these wretched pamphlets containing the latest discoveries of logic and philosophy must remain forever over their heads. Now, I want them to see that just as Nature has given them, as well as philosophers, eyes to see her works, so she has also given them brains capable of grasping and understanding them. (Drake, 2001: 13-14)

This gives us an insight into Galileo's mentality: opposed to the idea that knowledge was exclusively the province of experts, he held that the book of Nature was open to all who would look rather than rely on the authority of Aristotle. Indeed, Galileo insisted that if Aristotle were somehow to return, he would be the first to oppose the doctrines justified in his name. In a very famous passage in the *Assayer* in which he was critical of this tendency, he laid out its failings:

**Quote**

In Sarsi I seem to discern the firm belief that in philosophizing one must support oneself upon the opinion of some celebrated author, as if our minds ought to remain completely sterile and barren unless wedded to the reasoning of some other person. Possibly he thinks that philosophy is a book of fiction by some writer, like the *Iliad* or *Orlando Furioso*, productions in which the least important thing is whether what is written is there is true. Well, Sarsi, that is not how matters stand. Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these, one wanders about in a dark labyrinth. (VI, 232)

Many scholars have read this as indicative of Platonism in Galileo (Dijksterhuis makes this mistake, 1969: 337), but Drake explained (1999, 1: 53-54) that such a narrow reading misses the tripartite distinction Galileo was making between the universe, our attempts to understand it, and mathematics as a tool to aid us in so doing. This is very different from supposing mathematics to be the ultimate reality. Indeed, that Galileo did not even intend that philosophy had to be written in mathematical terms is immediate from the masterful way in which he used everyday metaphors, analogies and examples to explain his ideas. As an indicative instance, we may consider another excerpt from the *Assayer* that was beloved of Urban VIII. It concerns the story of a man who becomes fascinated by music and determines to seek out all possible sources of sound until he finds a cicada and becomes confused:
For having captured in his hands a cicada, he failed to diminish its strident noise either by closing its mouth or stopping its wings, yet he could not see it move the scales, which covered its body, or any other part. At last he lifted up the armour of its chest and there he saw some thin ligaments beneath, and thinking that the sound might come from their vibration, he decided to break them in order to silence it. But nothing happened until his needle drove too deep, and transfixing the creature he took away its life with its voice, so that he was still unable to determine whether the song had originated in those ligaments. This experience reduced him to diffidence, so that when asked how sounds were created he used to answer candidly that, although he knew some of the ways, he was certain many more existed that were unknown and unimaginable. (VI, 281)

Urban VIII was so pleased with the Assayer that he had it read to him while he ate (XIII, 141). This passage in particular embodied his own conviction that, since God could have created the universe in an infinity of ways, it was better to delight in that small part of it we may come to know than suppose useful hypotheses to be the whole truth on an issue.

Aside from attaching importance to mathematics as an instrumental language, Galileo also made a distinction between primary and secondary qualities (although he was not the first to do so) that would be taken up by Locke years later and which hinted at the mechanistic philosophy that would prove so important in the development of science (cf. Dijksterhuis, op cit: 333-359). When, in 1626, Grassi finally replied to the Assayer with his Ratio ponderum Librae et Simbellae, he took exception to the former, and specifically a passage in which Galileo had suggested that natural philosophy should be the study of "figures, numbers and local motion" (Fantoli, 1996: 293), not mere "names":

To excite in us tastes, odours and sounds I believe that nothing is required in external bodies except shapes, numbers, and slow or rapid movements. I think that if ears, tongues and noses were removed, shapes and numbers and motions would remain, but not odours or tastes or sounds. The latter, I believe, are nothing more than names when separated from living beings. (VI, 350)

This idea, still current in philosophy today and according to which eyes, light and wavelengths exist but "redness", say, does not, was seized upon by Grassi because he claimed that it had implications for the Catholic Eucharist, wherein bread is literally transformed into the body of Christ while maintaining its secondary qualities like taste and colour. If what was preserved as part of this miracle was nothing but "names", then nothing was preserved in reality and there is no miracle. Galileo was sufficiently worried by this accusation to ask Castelli to look into it (XIII, 389) and one Galileo scholar takes it as the basis of his interpretation of Galileo's subsequent trial (Redondi, 1987).

With Maffeo Barberini having ascended to the Papacy, Galileo again journeyed to Rome to pay his respects and to attempt to divine the attitude of the new Pope to his ideas and goals (XIII, 135). He arrived on the 23rd of April, 1624, and was granted no less than six audiences. He also met with Cardinals Antonio and Francesco Barberini, the brother and nephew of Urban VIII respectively (XIII, 175). On his departure in June, the Pontiff presented Galileo with a painting, a gold and a silver medal and several Agnus Dei. He was no closer to attaining his aim, however, and conceded that his discussions with Urban VIII had taught him that a prudent approach would be best (XIII, 179).
It is interesting to note the attitude that the Pope displayed toward the Copernican issue, considering more fully the instrumentalist thinking alluded to above. In an undated record of a conversation between Galileo and Urban VIII, the latter's Papal theologian, Agostino Oregio, explained that, having allowed all the arguments that Galileo had brought to bear on the question, the Pope asked him at the end whether God could not have the power and wisdom to dispose and move in another way the orbs and the stars and all that is seen in the sky and all that is said of the motions, order, location, distance and disposition of the stars... Because if God knew how and had the power to dispose all of this in another way than that which has been thought—in such wise as to save all that has been said—we cannot limit the divine power and wisdom to this way. (quoted by Fantoli, *op cit*, 322)

In response, said Oregio, "that most learned man [Galileo] remained silent." According to Urban VIII, then, astronomy must remain an instrumental science: if more than one system can save the appearances, or if there is no reason why other, currently unknown systems may not do likewise, we should view them as calculating devices or tools of prediction and not speak of their truth. This conception of theory evaluation will become important later.

Nevertheless, Galileo returned to Florence feeling that he could broach the issue of Copernicanism so long as he did so only in a hypothetical way. He decided to pursue a gradual course of action and devoted himself firstly to a paper that had been published back in 1616 by Francesco Ingoli, now secretary of the Congregation of the Propagation of the Faith. This pamphlet had disputed the Copernican system but, owing to the timing of events, Galileo had not felt that he could offer any rejoinder at that time. Kepler had already tackled Ingoli in 1618 and received a reply in turn. Galileo had been told by Tommaso Campanella (a Dominican who was imprisoned in Naples by the Inquisition for many years, largely for his political opinions, before his release by Urban VIII in 1629) in 1616 that he would author a criticism of Ingoli on his behalf (XII, 287), which Galileo declined—hardly the behaviour of a Copernican zealot but very much in keeping with a more accurate conception of Galileo as cautious and considered.

In his *Letter to Ingoli*, Galileo disavowed any theological argument and instead focused purely on the scientific areas of Ingoli's *Disputio*. Showing that the Copernican system was more in accordance with observation and reason, he explained that as a good Catholic he did not deny Copernicanism out of ignorance but instead...
because of the "reverence we have toward the writings of our Fathers" (VI, 511); that is, that Catholics were well aware of the support for Copernicus but, having understood it, placed their faith higher in import than interpreting astronomical theories as true representations. In part, this was in response to the suggestion in Protestant countries that the Church had banned all discussion of Copernicanism. This was referred to by Cardinal Zollern, Bishop of Osnabruck, who had reported to the Pope that "all heretics accept [Copernicus'] opinion and hold it as most certain" (XIII, 182). Attempts to convert Protestants in the German states were thus failing, he said, because of the perception there of the decree of 1616. Urban VIII had replied, according to Zollern, by saying that

> ... the Holy Church had not condemned [Copernicanism] nor was she about to condemn it now as heretical, but only as temerarious, though it was not to be feared that there would ever be anyone to demonstrate it as necessarily true. (ibid)

Much later, in 1630, Urban VIII would state that the decree "was never our intention; and if he had been left to us, that decree [of 1616] would not have been made" (XIV, 88).

Galileo's *Letter* took a long time to be published because the Church was investigating a complaint to the Holy Office concerning the *Assayer*. His friend Guidicci explained that a "pious person had proposed to prohibit or correct" the work (XIII, 265). According to a document discovered by Redondi in the archives of the Holy Office, the grievance also spoke of the atomism allegedly found in the *Assayer* as heretical (cf. Redondi, 1987: 137-202 for a discussion of this document and its anonymous author, together with 203-226 for more on the dispute on the Eucharist). The author objected that "if this philosophy of qualities is admitted to be true, it seems to me there follows a great difficulty in regard to the existence of the qualities of bread and wine which in the Holy Sacrament are separated from their own substance..." (in Finocchiaro, 1989: 203). Galileo's friends in Rome were understandably concerned.

Meanwhile Galileo returned to an idea that he first had when he moved to Padua (see Fantoli, *op cit*: 68), probably because it was more noticeable there: the phenomenon of the tides and their use as a possible argument against the fixed Earth. He wrote about it in several letters to friends in 1624 and still more in 1625 (XIII, 209 and 236, for example). This was to be the *Discourse on the ebb and flow of the sea*, in which he would consider the "two chief world systems" and the arguments for and against them, along with his thoughts on the tides and what they implied for the motion of the Earth. Although originally intending to finish the book swiftly (XIII, 295 suggests as much), family issues and health problems held him back. More importantly, it seems, the sheer *scope* of what he was attempting to achieve forced him to delay the writing as he sought more data and had to reconsider the direction he was taking in the light of objections (cf. XIV, 60).

After much work, Scheiner's response to Galileo was published in 1630 as *Rosa Ursina*, originally *De Maculis Solis* (or *On Sunspots*), Book One of which was largely a polemic against Galileo that took issue with his claims of plagiarism and reasserted Scheiner's priority (and independence) in the discovery of sunspots. Galileo's supporters replied in kind, but the far greater remainder of Scheiner's work was in fact a detailed critique of the incorruptibility of the heavens and other Aristotelian assumptions, coupled with "the most valuable treatise on solar physics of that epoch" (Fantoli, *op cit*: 332). Warned by Ciampoli via Castelli not to offer any comment (XIV, 330), perhaps to avoid any further deterioration in relations with the Jesuits, Galileo remained silent and continued with his own writing.

Late in 1629, Galileo was finally nearing the end of his work on the tides, completing it in April of the next year.
and writing to his French correspondent Elia Diodati that

**Quote**

In this [the *Dialogue*], besides the material on the tides, there will be inserted many other problems and a most ample confirmation of the Copernican system by showing the nullity of all that had been brought by Tycho and others to the contrary. (XIV, 49)

It is easy to read this as indicative of Galileo's zealous certainty of the truth of Copernicanism, but *confirmation* is not *proof*. We shall have occasion to discuss this distinction again below, but another letter to Buonamici gave a clear enough picture:

**Quote**

... I believe I have found the true reason for [the ebb and flow of the sea], very far from those to which up to now that effect has been attributed. I estimate it to be true and so do all of those with whom I have conferred about it. (XIV, 54)

We see here that Galileo *believed* and *estimated* the Copernican system to explain the tides, but that is a very long way from holding it to be certain and dedicating his life (or the greater part of it) to convincing others that it was so with all the rhetoric he could muster. (Indeed, at the close of his life Galileo apparently came to doubt the argument from the tides (XVII, 215)).

**The Publication of the *Dialogue***

It was agreed late in 1629 that the *Dialogue* would be published in Rome, so Galileo again prepared to travel there to aid with the arrangements. Ill health intervened as usual, however, and it was May, 1630 before he arrived. He lodged with Francesco Niccolini, the Tuscan Ambassador since 1621, and his wife Caterina Riccardi (who was related to Niccol Riccardi, the Dominican who had cleared the *Assayer* for publication and written so highly of it). Galileo was again received by the Pope, the positive result of their discussions (XIV,105) apparently leaving him feeling he was free to publish his work.

At the same time, Galileo's enemies were just as busy, attributing to him a horoscope that foretold the death of Urban VIII and his nephew. The Pontiff, who was deeply superstitious, imprisoned the actual author, Orazio Morandi (who subsequently died in prison) and let it be known that Galileo "had no better friend than [Cardinal Francesco Barberini] and the Pope himself, and that he knew who he was and he knew that he did not have these kinds of matters in his head" (XIV, 111). Nevertheless, Urban VIII was under increasing political pressure as a result of the Thirty Years War and the strength of Cardinal Richelieu within France, such that Riccardi knew the publication of the *Dialogue* would have to be a delicate process.

Having realised that the *Dialogue* would be read as sympathetic to Copernicanism, the first thing Riccardi did was to insist that a preface and conclusion should be added, emphasising the hypothetical nature of the study and hence showing "that the Holy Congregation in reproving Copernicus had acted in an entirely reasonable way" (XIX, 325). He then passed the manuscript to Raffaele Visconti, Master of the Sacred Palace and also a professor of mathematics, who approved it. Riccardi was still not happy, though, possibly because he learned that Urban VIII had stated his annoyance at Galileo's claim that the tides depended on the motion of the Earth (XIV, 113—we can refer back to the Pontiff's instrumentalism to understand why). Riccardi decided to review it himself and
discussed it with the Pope, who insisted that the title show no reference to the ebb and flow of the sea but instead should speak of the "Chief World Systems", or something similar. Satisfied that the *imprimatur* would be granted, Galileo returned to Florence after yet another visit to Urban VIII.

It had been agreed that the *Dialogue* would, as usual, be printed by the *Accademia dei Lincei*, but on the 1st of August 1630 Prince Cesi died, leaving neither will nor successor at the Academy. Following this deeply saddening event for Galileo, Castelli suggested that he perhaps look to publish in Florence instead (XIV, 135). When Riccardi was asked if he would agree to this arrangement, he declared that he would need a copy first in order to correct it, after which Galileo could publish it wherever he liked (XIV, 150). The plague then raging throughout Italy prevented both travel and post, however, so Galileo requested to be able to amend the work in Florence while leaving only the preface and conclusion to be eventually forwarded to Riccardi in Rome for his consideration. After a diplomatic battle, in which Ambassador Niccolini’s wife leant heavily on her relative, Riccardi agreed, with the caveat that the final draft be reviewed locally. This task was entrusted, at Galileo’s application, to Father Jacinto Stefani, a Dominican.

Riccardi received the preface and conclusion in accordance with this agreement but still stalled, causing Galileo to finally lose patience and refer the matter to the Tuscan Secretary of State (XIV, 217), who brought it to the attention of the Grand Duke. The latter instructed his Ambassador, Niccolini, to move on his behalf, but Riccardi again refused to be rushed. Still more pressure from the Ambassador and his wife resulted in Riccardi proposing much the same compromise as before, except that this time he would send instructions (XIX, 327) to the Florentine Inquisitor, Clemente Egidi, having checked the opening and closing sections himself. Galileo remained deeply frustrated at this performance (XIV, 254) but eventually sent the required passages to Riccardi. Ultimately, Riccardi absolved himself of all responsibility by devolving the decision of whether or not to grant the *imprimatur* to Egidi. This final permission having at last been gained, printing began and early in 1632 the first copies were ready for sale.

There is no question that Galileo had every right to be annoyed at Riccardi’s behaviour, particularly the unprecedented decision to insist on a second revision. Even so, Riccardi—like Niccolini—was aware of the
political climate in Rome and how sensitive the publication was likely to be, Nicolini remarking that "the truth is that these opinions are not received well here, especially by superiors" (XIV, 251).

The full title of the work, as insisted upon by Urban VIII, was

Dialogue of Galileo Galilei, Lincean, Special mathematician to the University of Pisa and Philosopher and Chief Mathematician to the Most Serene Grand Duke of Tuscany, where, in the meetings of four days, there is discussion concerning the two Chief Systems of the World, Ptolemaic and Copernican, propounding inconclusively the philosophical and physical reasons as much for one side as for the other...

abbreviated ever since the 1744 edition as the Dialogue on the two Chief World Systems. The action unfolded over this period of four days as a conversation between Salviati, Galileo's spokesman and (late) great friend Filipo, and Simplicio, named for the sixth century commentator on Aristotle and very much the defender of Aristotelian orthodoxy. The two are joined by Sagredo, the "educated layman between two experts", called after Galileo's best friend during his time in Padua who had died in 1620. A (deliberate) circumstance that would later lead to more trouble for Galileo was the added fact that Simplicio in Italian gives the sense of "simple" or simpleton", and this is indeed descriptive of how he behaved throughout the text.

In his preface, Galileo began by stating that he would show that the decree of 1616 had not had the effect supposed by others (that is, Protestants) and thus proposed "to show to foreign nations that as much is understood of this matter in Italy, and particularly in Rome, as transalpine diligence can ever have imagined" (VII, 29). He went on to say that it would be demonstrated that "all experiments practicable upon the earth are insufficient measures for proving its mobility, since they are indifferently adaptable to a earth in motion or at rest", followed by an examination of "celestial phenomena... strengthening the Copernican hypothesis until it might seem that this must triumph absolutely" and then a look at the tides "from assuming the motion of the earth". All this was ostensibly to illustrate the rationality of the Catholic position as having come about "not from failing to take count of what others have thought" but "for those reasons that are supplied by piety, religion, the knowledge of Divine Omnipotence, and a consciousness of the limitations of the human mind" (ibid, 30); that is, the position of Urban VIII. As we shall see, some of his more important readers were unfortunately not convinced of his sincerity in holding it.

The Arguments Against Galileo (2)

Political issues aside, there remained an excellent and straightforward reason why Galileo had struggled to convince people that the Earth moves: it plainly does no such thing. At that time, common sense gave the lie to Copernicanism in ways that anyone could understand: if the Earth moves, why do birds flying not get left behind? If an arrow is fired straight up into the air, with the Earth spinning at countless miles per hour, why does it fall at (or near) the feet of the firer? Likewise, why does a stone dropped from a tower land at the base, instead of some distance away? This last is the famous tower argument that was considered a total refutation of the motion of the Earth and which Galileo later treated of in the eighth part of the Second Day in his Dialogue, along with its equivalents that involved either dropping a lead ball from the masts of stationary and moving ship and comparing the different landing positions or firing cannons East and West and doing similarly.

In keeping with these common sense objections, a more philosophical counter-argument suggested that reasoning in support of Copernicanism committed the logical fallacy of affirming the consequent. Consider, for
example, Galileo's intention to look at the tides on the assumption that the Earth moves. In the course of his discussion, critics said, he proceeded in this fashion:

- First Premise: If the Earth moves, we would observe phenomenon $x$ (the tides, say);
- Second Premise: We observe phenomenon $x$;
- Conclusion: Therefore, the Earth moves.

This is the formal fallacy of affirming the consequent (the basic form being "if $P$ then $Q$; $Q$; therefore, $P$"). In layman's terms, that an hypothesis such as the Earth moving could explain the observations did not imply that it was therefore a true hypothesis, not least because there might be others that could do likewise (as indeed there were, according to those who held to the Tychonic system). A fallacious argument seemed to give no reason to abandon either common sense or the instrumental interpretation of theories.

It was also said that Copernicanism was *simpler* as a mathematical construct and ought to be preferred on that basis alone. This, of course, is in keeping with the general preference for parsimony or simplicity in theories that has characterised much (but not all) science for very many years (cf. Holton, 1988). Since Copernicus could explain on the basis of geokineticism what the Ptolemaic system could only manage with the addition of a complicated structure of eccentrics, epicycles, deferents and equants, his ideas must be closer to the true picture (if indeed they were to be read realistically) or easy to use. However, Copernicus actually introduced epicycles of his own, and even epicycles on top of these, leading Cohen to exclaim that the notion of Copernicus's system being the simpler should be taken "*cum grano salis*, in fact, with the whole cellar" (2001: 111). This, in any case, is a modern argument, one that Galileo did not face. In his time, the question of which system was simpler does not appear to have been asked (Cohen, *op cit*: 116).

Galileo's use of the telescope has caused much discussion, too. As we noted above, many people refused to
look through the telescope or, having done so, refused to believe what they saw. Although we may regard the former position as ridiculous, the latter was rather more justified. The telescope was a new invention and to some it must have seemed like magic. How, Clavius asked, could it be known that what was seen was actually there, rather than a trick of the lenses? As Feyerabend (op cit) and Kuhn (1975: 224) have remarked, Galileo had no theory of optics to answer this criticism, so he relied instead on demonstrations. By pointing his telescope at something terrestrial in the distance, observers could verify for themselves that it had shown a true representation of what was there. There was no guarantee, however, that this should hold when the telescope was raised to the heavens. The situation changed somewhat when the Jesuits announced that they had confirmed Galileo's studies with the telescope, but this, too, was merely a useful (albeit powerful) aid and not a proof. The effect of Galileo's public shows was nevertheless such that this objection remains a recent (and philosophical) one, particularly in the *reductio* form employed by Feyerabend.

Another relatively recent argument frequently used to justify the second of the myths we began with concerns the tides. It is said that Galileo was wrong about what caused them (as we saw above, he eventually agreed that the moon was responsible, although, as we shall see, this is not quite accurate) and his use of them to prove Copernicanism was flawed. That the error lies in the other direction will become apparent shortly but since, in his *Dialogue*, the first thing Galileo had to do was tackle the appeal to common sense, that is where we shall begin.

**Philosophy of Science and the Galileo Affair**

On the second day of discussion, Galileo has Salviati remark on another author (Chiaramonti) who had suggested that those who would disagree with the tower argument must see a stone dropped from the top falling not straight down but in an arc:

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> ... in this way he hints at believing that to those who say that such motion is not straight at all, but rather circular, it seems they see the stone move visibly in an arc, since he calls upon their senses rather than reason to clarify the effect. This is not the case, Simplicio, for just as I ... have never seen nor ever expect to see, the rock fall any way but perpendicularly, just so do I believe that it appears to the eyes of everyone else. It is, therefore, better to put aside the appearance, on which we all agree, and to use the power of reason either to confirm its reality or to reveal its fallacy. (Drake, op cit: 126)

Note that Galileo's strategy here was to *agree* with the common sense view of what happens when a stone is dropped from a tower but to challenge its *interpretation*; that is, to challenge the "basic epistemological principle ... that under normal conditions the human sense are reliable, that they tell us what is really happening, that normal observation reveals reality to us" (Finicchiaro, 1997: 56). Although circumstances opposing this principle were not new (observing a stick in water to be bent when its removal reveals it to be straight, for example, or the one given by Galileo immediately after the tower argument—that of the moon following us as we walk.), Galileo apparently proposed here to put aside the appearances and place *reason* as the highest court of appeal. This brought (and brings) up many associated questions: when are our senses reliable? When should the evidence of common observation be rejected? Should we always appeal to reason over observation, or only when there is controversy? How do we demarcate between controversial and non-controversial issues? And so on.

When we read on, we find that Galileo did *not* in fact propose to supplant one principle with another, instead calling for the use of the senses "*accompanied by reasoning*" (op cit: 255, italics added). In general, philosophers and historians of science have seemed determined to characterise Galileo's science in one way or another while
at the same time contriving to overlook the subtlety in his works. Still on the second day, Galileo sketched the scene of two friends in a ship's cabin, throwing a ball to each other and taking note of the movements of fish, butterflies and the like that happen to be with them. On the first occasion this situation plays out while the ship is at rest alongside; on the second, it is underway. The friends in the former notice no difference in the force needed to throw the ball in one direction rather than another and observe no similar difficulty in the animal sharing the cabin with them. This remains the case, according to Galileo, for the latter, too.

This is the introduction of **Galilean relativity**, which was relied on much later by Einstein. From the perspective of the friends in the cabin, the motion of the ship relative to land has no effect on the motion of the ball relative to the cabin, since the additional motion imparted to the ball by the motion of the ship is also granted to the cabin. This implied that the stone dropped from the mast of a moving ship appears to fall straight down because its motion in any other direction is shared by the ship—or the **inertial frame** in modern parlance—so that the observer sees only a straight descent. Likewise, the stone dropped from a tower on a moving Earth is not viewed from an absolute point of reference but relative to the tower and its immediate surroundings, which are (according to the assumption of geokineticism) also moving.

The importance of relativity can scarcely be overstated, but what Galileo was able to do was take an observation that refuted geokineticism, re-describe it, and so turn it into a confirmation of the Earth's movement. This is an example of **meaning variance** between theories, a concept that would later form the basis of the notion of incommensurability. It shows Galileo not to be rejecting observation on the basis of theory, or vice versa, but using reasoning to invite his readers to consider the evidence of their senses in a new way in support of a different worldview. Any effort to cast him solely as an empiricist or a rationalist, then, is bound to fail.

Another fascinating approach to the motion of the Earth that was discussed by Copernicus and which involved the Aristotelian theory of **place**, which Aristotle himself had defined as "what contains that of which it is the place" (*Physics*, IV, 211a). Although Finocchiaro (1997:14) remarked that natural motion "has always been regarded as an essential or defining characteristic of a physical body. This seems to have remained unchanged even by the Copernican Revolution", he failed to realise the importance this held for Copernicus. In the Aristotelian system, the outermost sphere of the heavens was supposed to have a natural motion but it could have no place, since, being uncontained in any further sphere, no place could be granted to it under Aristotle's conception above. Thus Aristotle was left with the unfortunate situation in which the outer sphere had natural motion but no place; and since it had no place it could have no motion, which was defined as a change in place. Max Jammer explained that one consequence was that

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**Quote**

... Copernicus finally came to the conclusion that that the two ideas [Aristotelian place and natural motion] were irreconcilable, and that at least one of them would have to be rejected. Either the definition of "place" had to be revised, or the dogma of the motion of the outermost celestial sphere had to be repudiated. As we know, Copernicus preferred the second alternative. (1993: 72-73)
In his *De revolutionibus orbium celestium*, Copernicus drew attention to this difficulty by saying that "since it is the heavens which contain and embrace all things as the place common to the universe, it will not be clear at once why movement should not be assigned to the contained rather than to the container" (1953: 515), later calling the latter option "absurd" (*op cit*: 520). That there was no way around this issue was clear to Copernicus in the late sixteenth century but not to philosophers of science in the twentieth, it seems. Whether the Aristotelian concept of place or the fixed Earth had to be rejected, his authority and infallibility could no longer be maintained.

It is well known that Copernicanism was slow to gain a following, with only ten Copernicans noted between 1543 and 1600 (those being Rheticus; Maestlin; Rothmann; Kepler; Bruno; Galileo himself; Digges, Harriot; de Zuiga; and Stevin) (Westman, 1986:85). One of the main (logical) objections to it was that it engaged in circular reasoning. That is, the motion of the Earth was assumed in order to explain phenomena; whereupon the excellence of the explanations was taken to imply the motion of the Earth (more strictly, this is affirming the consequent as before). In the *Dialogue*, Galileo had Simplicio voice this concern:

> I do not think it can be denied that your argument goes along very plausibly, the reasoning being *ex suppositione* as we say, that is, assuming that the earth does move in the two motions assigned to it by Copernicus. But if we exclude those movements, all the rest is vain and invalid; and exclusion of this hypothesis is very clearly indicated to us by your own reasoning. Under the assumption of the two terrestrial movements, you give reasons for the ebb and flow, and then vice versa, reasoning circularly, you draw from the ebbing and flowing the sign and confirmation of those same two movements. (*op cit*: 436)

This philosophical criticism is enough to end all possibility of definitively proving Copernicanism. Nevertheless, some philosophers of science have chosen to portray Galileo as a Copernican zealot in spite of his stating plainly—rather than excluding—an objection at the close of his work that would have demonstrated to any
philosophically-inclined reader than no such proof was to be found in the book (nor, in principle, could there be). Why would a determined Copernican desperate to convince others of his certainty offer such a decisive refutation of his own position? The question can only be rhetorical. It is hard to see why we should not instead read Galileo as having honestly confronted what he knew would be the main focus of philosophical disapproval, not least because he leaves this criticism unanswered. Indeed, given the contexts already established above, it would seem that his argument was to be a probabilistic one which showed both that the Ptolemaic system was untenable and that the Copernican was at least plausible, if not likely on the balance of the observations and reasoning available. Once again, Galileo the passionate advocate of Copernicanism gives ways to Galileo the prudent defender of his Church.

Supporters of the second myth we began with have looked elsewhere for justification of their reading of the Galileo affair. Another strand has focused on the idea that Bellarmine and the Church correctly rejected Copernicanism as unscientific (cf. Feyerabend, 1993: 126-129—his 2002: 247-264 is a distinct approach to the same question—and Duhem, 1908), with Duhem (op cit, quoted in de Santillana, 1958: 107) asserting that "[l]ogic was on the side of Osiander and Bellarmine and not on that of Kepler and Galileo". Bellarmine's letter to Foscarini of 1615 (XII, 171-172), quoted previously, is typically offered as indicative of his scientific bent, the charge being that while Galileo supposedly wanted unproven theories to be accepted as true, Bellarmine was far more reasonable in stating that Scriptural interpretations should not be changed on this faulty basis and that merely saving the appearances is not enough to render a theory true. This is the third point of the letter, however, and in emphasising it we lose sight of the second:

Consider now, with your sense of prudence, whether the church can tolerate giving Scripture a meaning contrary to the Holy Fathers and to all the Greek and Latin commentators. Nor can one answer that this is not a matter of faith, since it is not a matter of faith ex parte objecti [as regards the topic or object of discussion], it is a matter of faith ex parte dicentis [as regards the speaker]; and so it would be heretical to say that Abraham did not have two children and Jacob twelve, as well as to say that Christ was not born of a virgin, because both are said by the Holy Spirit through the mouth of the prophets and the apostles. (op cit)

Here Bellarmine had given a very different principle, according to which all Scriptural passages were to be taken as coming through the writer directly from the Holy Spirit. Supposing, then, with Galileo, that the motion of the Earth is not a matter of faith because it is an astronomical issue is thus rejected by Bellarmine because the source of the Biblical statements on geostaticism and geocentrism is the Holy Spirit. Any dissent is thus straightforwardly heretical. We see at once that this approach renders Bellarmine's "scientific" remarks in the rest of his letter moot: "If Scripture statements on the motion of the Sun are 'matters of faith' in the sense indicated by Bellarmine, they constituted truths which could not be doubted and which could never be overturned by whatever progress science might make" (Fantoli, op cit: 187). No amount of subsequent investigation could over-rule the fact that the Holy Spirit had declared in Scripture that the Earth did not move—precisely the stance that Galileo was trying to remove because he thought that it would place his Church in a very difficult position (and subject to ridicule) if, as it seemed, Copernicism should be true or, at any rate and with the same consequence, the Ptolemaic system false. To call Bellarmine's position scientific when its rigorous application would have killed science completely is, to be blunt, quite absurd.

Another criticism of Galileo states that he was condemned by his own opinions from his Letter to Christina (for example, Shea, 2003:73-74):
These words imply I think the following doctrine: in the learned books of worldly authors are contained some propositions about nature which are truly demonstrated and others which are simply taught; in regard to the former, the task of the wise theologians is to show that they are not contrary to Holy Scripture; as for the latter (which are taught but not demonstrated with necessity), if they contain anything contrary to the Holy Writ, then they must be considered indubitably false and must be demonstrated such by every possible means. (V, 327)

The lesson here is supposed to be clear: if a proposition is not demonstrated as necessarily true, the Church was quite correct to assert their falsity and use "every possible means" to ensure that this is known to be the case. Galileo, then, could have no complaint. Nevertheless, we need only consider the very next lines of the Letter to see what Galileo had meant:

So physical conclusions which have been truly demonstrated should not be given a lower place than Scriptural passages, but rather one should clarify how such passages do not contradict those conclusions; therefore, before condemning a physical proposition, one must show that it is not conclusively demonstrated. Furthermore it is much more reasonable and natural that this be done not by those who hold it to be true, but by those who regard it as false... (op cit)

This is the eminently sensible idea that a proposition should not be condemned as heretical unless it has been shown to not be demonstrated, thus preventing people from merely declaring Copernicanism to be false in order to have it condemned by the authorities. Moreover, those who would wish to have it condemned should have the burden of proof associated with that claim. This would require that any theologian who wished to see a scientific proposition condemned would have to show that it ought to be, and hence would have to understand it sufficiently to justify his claim that it was not demonstrated to a degree that would imply changing the interpretation of Scripture accordingly. Given the fate that could await the heretic, this is both reasonable and—at the very least—just. Once again, we see that the effort to sustain the second myth can lead to illiteracy.

When Galileo finally came to discuss the ebb and flow of the sea on the fourth day (although this ordering is open to doubt), he was disdainful of the idea that the Moon had a significant influence on the tides. He rejected the supposed attraction between the Moon and Earth as part of his general objection to "occult properties" (VII, 486) and sought a terrestrial, mechanical explanation. Since there was no proof or theory of gravitational attraction at that time, we might expect Galileo to be lauded by mythicists in the second sense for his (Bellarminean) scientific rejection of gravitational explanations of the tides. Instead, he is criticised for having held the incorrect opinion. In fact, there is an effect on the tides caused by the diurnal rotation of the Earth. Moreover, Galileo was well aware of the sheer complexity of the phenomenon and gave many factors that played a part in his theory (Dialogue, 457-462). Thus did Drake observe that "the departure of presentations of Galileo's theory from what he wrote goes ever widening" (1999, 2: 111). That Galileo did not consider his argument a proof of Copernicanism has already been established, but this attempt to justify the second myth remains popular. In short, Galileo's theory was "incorrect but scientific" (Drake, 2001: 93) and modern tidal theories retain a degree of intricacy that renders any attempt to speak of Galileo's as "inadequate" little more than anachronism (cf. Drake, 1999, 2: 107).

Galileo's stated purpose in the Letter, his correspondence and in the Dialogue itself was in any case already being practised by the Church. As is well known, there are Biblical passages suggesting a flat Earth (Daniel 4:11, for instance) that were not interpreted realistically (although Bellarmine's principle would have meant otherwise)
and for the Church to insist on a literal reading would have been thought ridiculous, particularly by the
Protestants. What Galileo was asking for, then, was neither new nor controversial. This should lead us to a
rejection of the first myth, of course, because Galileo did get into trouble all the same.
The reception of the *Dialogue* among Galileo's friends was enthusiastic (XIV, 357), as could have been expected. Riccardi received a copy and made no complaint (Paschini, 1965: 501), which will prove relevant later. Meanwhile, political events were overtaking all other aspects to the affair.

Urban VIII's attempts to sail a course between the French and the Hapsburgs during the Thirty Years War had come unstuck when he was accused by the Spanish of favouring the French. Galileo's friend Ciampoli became mixed up in the affair, having been befriended by Cardinal Gaspare Borgia, Ambassador to Spain, and the Spanish group in general. In March of 1632 Borgia, backed by another seven Cardinals, publicly criticised the Pope at a consistory, accusing him of favouring heretics and lacking apostolic zeal, leading almost to a brawl when the Pontiff's brother, Cardinal Antonio Barberini, took exception. (See Redondi, 1987: 227-232 for a full account of these events.) Stung by these and other accusations and unable to do anything against Borgia himself, Urban VIII acted against the group around him, expelling Cardinal Ludovisi for his support for Borgia and his threats to depose the Pope. Ciampoli, who had had Ludovisi as a patron and who was close to Cardinals Ubaldini and Aldobrandi, other members of the group, was dismissed for his association with the Spanish party. (Some, including Ambassador Niccolini, gave another reason for Ciampoli's fall: overconfident in his own abilities, he had taken a letter of the Pontiff's written in Latin and rewritten it, showing the result to friends. The Pope, being a man of letters and deeply proud of his own abilities, was stung to the quick. (Fantoli, 1996: 457-458))

In April, the Protestant army of Adolphus reached Bavaria and began to loot the Jesuit Colleges. Urban VIII was caught between the demands of Philip IV and Ferdinand II to act against Adolphus and Cardinal Richelieu's suggestions to split with Spain. His indecision did not last long, however, because Adolphus reached the Alps in May and threatened to head for Rome. The Pope was forced to capitulate to the Spanish demands completely. With this political upheaval came a sea change in outlook, with many artists leaving Rome and the culture of
patronage being stunted. Urban VIII took to sealing himself within Castel Gandolfo, suspecting everyone (Biagioli, 1993: 336).

The Dialogue is a massive tome, running to 465 pages in Drake's 1953 translation. Copies began to arrive in Rome in July and August, but it is unlikely that the Pope had had the time or inclination to read it, with other problems on his mind. Nevertheless, it is likely that Galileo's enemies had succeeded in informing the Pontiff of its contents by July and he eventually saw for himself that his argument against interpreting astronomical theories as real put into the mouth of Simplicio, the simpleton (Fantoli, 1996: 459). Deeply upset at what he saw as his betrayal by Galileo, Urban VIII immediately ordered the book suspended, as Riccardi explained:

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... it is the wish of Our Lord (but no more than my name is to be mentioned) that the book be withheld and that it not be sent here without there having been sent from here that which is to be corrected, nor should it be sent to other places. (XX, 571-572)

In the same letter, Riccardi asked about the picture of three dolphins found on the frontispiece. This was merely the logo of the publisher, Landini, but the Pope suspected it was an insinuation about the way in which he was perceived to protect his nephews. Everything was piling up around him and the Dialogue was but the last straw. "Something had burned out in Urban VIII's heart: the admiration he had for Galileo..." (Fantoli, op cit: 394).

In a long letter to Guidicci from Filippo Magaloti, a Florentine and relative of the Pontiff, the latter explained that the work was being recalled only to add the arguments that Urban VIII had used to convince Galileo "of the falsity of the Copernican theory". Having said this, he became more candid:

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This is the pretext; but the real fact is that the Jesuit Fathers are working most valiantly in an underhanded way to get the work prohibited. The reverend Father's [Riccardi's] own words to me were: 'The Jesuits will persecute him most bitterly.' (XIV, 370)

Galileo protested the blocking of the distribution of the Dialogue in the strongest terms, but Ambassador Niccolini described the difficulties in a letter of August 1632:

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... I have not been able to see the Master of the Sacred Palace [Riccardi] in regard to the question of Mr. Galilei. However, because I hear that there has been set up a Commission of persons versed in his profession, all unfriendly to Galileo, responsible to the Lord Cardinal Barberini, I have decided to speak about it to his Eminence himself at the earliest opportunity. Furthermore, because they are thinking of calling a mathematician from Pisa, named Mr. Chiaramonti and rather unfriendly to Mr. Galileo's opinions, it will be necessary that His Highness have someone talk to him, to make sure he pursues the cause of truth here, rather than his emotional feelings... (XIV, 372)

Secretary of State Cioli replied that the Grand Duke would "take it badly if persecution of his works by those who
are envious of his learning continues" (XIV, 373). Unfortunately Galileo's enemies had succeeded in allying the Pope to their cause and it was too late, in spite of Cioli's and Niccolini's best efforts. The latter remarked on this when he wrote that "when his Holiness becomes obstinate, it is a lost cause, especially so if one has intentions of opposing or threatening or asserting oneself, because under those conditions he is hard to deal with and shows respect for no one" (XIV, 385). Nevertheless, we can see plainly that the machinations of these "envious" people had very little (if at all, even at the beginning) to do with religion or its purported conflict with science and everything to do with politics, jealousy and misunderstandings—in short, too many factors to make any generalised (mythical) account tenable.

On the 5th of September, Niccolini again wrote to Cioli to give his account of the meeting he had had with Urban VIII the day before. It does not make for pleasant reading, except for the principled and dedicated way Niccolini stuck to his assignment and tried to defend Galileo in a situation he knew he could not hope to save. After stating his agreement with the Grand Duke that "the sky is about to fall", he went on to describe how things had gone from bad to worse:

> **Quote**
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> While we were discussing those delicate subjects of the Holy Office, His Holiness exploded into great anger, and suddenly he told me that even our Galileo had dared entering where he should not have, into the most serious and dangerous subjects which could be stirred up at this time. I replied that Mr. Galilei had not published without the approval of his ministers and that for that purpose I myself had obtained and sent the prefaces to your city. He answered, with the same outburst of rage, that he had been deceived by Galileo and Ciampoli, that in particular Ciampoli had dared tell him that Mr. Galilei was ready to do all His Holiness ordered and that everything was fine... (quoted in Finocchiaro, 1989: 229-232)

Thus did the Pope associate Galileo with Ciampoli and allege a joint ruse, a charge he would repeat ("his complaint was to have been deceived by Galileo and Ciampoli"). When Niccolini begged for Galileo to have the chance to explain himself before a fair panel, the Pontiff declared that "in these matters of the Holy Office the procedure was simply to arrive at a censure and then call the defendant to recant". Urban VIII's responses became increasingly violent as the Ambassador pressed the issue, the latter summarising their discussion by remarking that "I feel the Pope could not have a worse disposition toward our poor Mr. Galilei" (*op cit*).

Although Riccardi tried to assure the Ambassador that all that was required were some adjustments to the text (XIV, 389), matters came to a head when a document was discovered in the files of the Holy Office which apparently showed Galileo have been ordered not to "hold, teach or defend" Copernicanism "in any way". Since this injunction is so important to the subsequent trial, we shall quote it in full:

> **Quote**
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> At the palace of the usual residence of the said Most Illustrious Lord Cardinal Bellarmine and in the chambers of His Most Illustrious Lordship, and fully in the presence of the Reverend Father Michelangelo Segizzi of Lodi, O.P. and Commissary General of the Holy Office, having summoned the above-mentioned Galileo before himself, the same Most Illustrious Lord Cardinal warned Galileo that the above-mentioned opinion was erroneous and that he should abandon it; and thereafter, indeed immediately, before me and witnesses, the Most Illustrious Lord Cardinal himself being also present still, the aforesaid Father Commissary, in the name of His Holiness the Pope and the whole Congregation of the Holy Office, ordered and enjoined the said Galileo, who was himself still present, to abandon completely the above-mentioned opinion that the sun stands still at the centre of the world and the earth
moves, and henceforth not to hold, teach, or defend it in any way whatever, either orally or in writing; otherwise the Holy Office would start proceedings against him. The same Galileo acquiesced in this injunction and promised to obey. (Finocchiaro, op cit: 147-148)

Since it was plain to anyone who had read the Dialogue that Galileo had broken these terms, it seemed he was finished. Urban VIII's Commission inevitably decided that the Holy Office should investigate the work (XIV, 398) and on the 23rd of September the Congregation met to discuss the Commission's report. There he was charged with having "been deceitfully silent about the command laid upon him by the Holy Office, in the year 1616" (XIX, 279-280) and the Pope ordered that Galileo be brought to Rome by October to appear before the Commissary general.

Galileo received this command from the Florentine Inquisitor on the 1st of October and agreed to follow it (XIX, 331-332). He could do little else. Even so, he wrote to Cardinal Francesco Barberini to ask for his help, suggesting that an alternative to the long journey to Rome would be to appear before the Inquisitor in Florence (XIV, 410). Galileo was seventy years old at this stage and did not think he had any significant amount of his life remaining. Meanwhile, Galileo's friends tried to assist him as best they could, with Castelli talking to Riccardi and Vincenzo Maculano, the Commissary of the Holy Office. The Grand Duke himself became involved, instructing Niccolini to do "everything that might ever be possible to help him" (XIV, 413). The Ambassador met with Urban VIII in November and attempted to appeal to Galileo's age and ill health, but the Pope could not be swayed. The latter did, however, grant that the conditions of Galileo's quarantine would be eased as far as possible. Cardinal Francesco Barberini apologised for not being able to offer an opinion other than that of his uncle, the Pontiff, but he also pledged to do whatever he could to see that Galileo did not suffer (XIV, 427). Nevertheless, the Pope insisted that Galileo be forced to come to Rome (XIX, 280) in spite of the latter being so sick that he was confined to his bed. It was clear that Urban VIII was still bitter at having been deceived, as he put it (XIV, 428-429). When Galileo at last sent word of his poor health, certified by three doctors, the Pope "commanded that we [the Holy Office] write to the inquisitor that his Holiness and the Sacred Congregation cannot and absolutely must not tolerate subterfuges of this sort" (XIX, 281-282). Eventually it was decided that doctors from Rome would visit Galileo at his own expense to determine the extent of his illness, particular since "he is the one who has reduced himself to this state of affairs" (ibid).

Thus it was that Galileo finally left for Rome in January of 1633, the Grand Duke having offered him a carriage to travel in and accommodation with Ambassador Niccolini, who treated him with "indescribable kindness" from his arrival in February. The wheels of the Holy Office moved slowly, however, and Galileo struggled to find out what was going on, still supposing that his honesty and faith could save him. He remained ignorant of the sheer extent of the forces arrayed against him, even as others were very clear that he "suffer[ed] from the envy of those who saw in him the only obstacle to their having the reputation of the highest mathematicians" (Holste to de Peiresc, XV, 62). Niccolini spoke again with the Pope in March, finding this time that Urban VIII made specific reference to his own argument of the omnipotence of God and His power to make the world in any way He chose. When the Pontiff began to lose his temper in response to the Ambassador's objections, the matter had to be dropped (XV, 68). At last, in April, Galileo was called before the Congregation of the Holy Office to be interrogated.

The Trial and Verdict

Galileo appeared before Commissary Maculano on the 12th of April and was interviewed on the same day (XIX, 336-342 and Finocchiaro, 1989: 256-262). After some preliminaries, Maculano focused on what Galileo had been told by Bellarmine in 1616, the former knowing of the document quoted above. Galileo replied that
Lord Cardinal Bellarmine told me that Copernicus's opinion could be held suppositionally, as Copernicus himself had held it. His Eminence knew that I held it suppositionally, namely in the way that Copernicus held it, as you can see from an answer by the same Lord Cardinal to a letter of Father Master Paolo Antonio Foscarini, Provincial of the Carmelites; I have a copy of this, and in it one finds these words: "I say that it seems to me that Your Paternity and M. Galileo are proceeding prudently by limiting yourselves to speaking suppositionally and not absolutely." (Finocchiaro, op cit)

Then came the decisive issue: asked what he had been told by Bellarmine in 1616 at the time of being informed of the decree of the Index, Galileo said that "Lord Cardinal Bellarmine told me that since Copernicus's opinion, taken absolutely, was contrary to Holy Scripture, it could neither be held nor defended, but it could be taken and used suppositionally" (ibid). He then produced a copy of a signed note from Bellarmine, stating to this effect. This was obviously a surprise to Maculano, but he pressed the main issue of whether Galileo had been enjoined upon not to "teach, hold or defend in any way". Galileo answered that

I do remember that the injunction was that I could not hold or defend, and even that I could not teach. I do not recall, further, that there was the phrase in any way whatever, but maybe there was; in fact, I did not think about it or keep it in mind, having received a few months thereafter Lord Cardinal Bellarmine's certificate dated 26 May which I have presented and in which is explained the order given to me not to hold or defend the said opinion. Regarding the other two phrases in the said injunction now mentioned, namely not to teach and in any way whatever, I did not retain them in my memory, I think because they are not contained in the said certificate, which I relied upon and kept as a reminder. (ibid)

The discrepancy between the document of the Holy Office and the one signed by Bellarmine was such that Maculano had to ask Galileo for more detail on who was present at the 1616 meeting at Bellarmine's residence. Using the former piece of evidence, the Commissary tried to jog Galileo's memory but was told the same thing: Bellarmine had said that he could not hold or defend Copernicanism, but Galileo did not recall any additional remarks about not teaching in any way whatever. Notwithstanding the context of Bellarmine's certificate, Galileo
was stood over while the Holy Office appointed three theologians, Oreggi, Inchofer and Pasqualigo, to examine the *Dialogue* (again, in the case of the first two) in order to determine if Galileo had transgressed the order he was given *in the first formulation*. The result (*op cit*, 262-276) was a foregone conclusion, of course, and thus constituted (at this time) an aggravating circumstance—that is, Galileo's apparent dishonesty on this matter.

Many Galileo scholars have attempted to explain the existence of these two—seemingly contradictory—pieces of written evidence. Perhaps the most interesting were Stillman Drake's (1999, 1:142-152) and Guido Morpurgo-Tagliabue's (1963: 14-25; they are similar in almost all respects), which suggested that Michael Seghizzi, then Commissary General, was present when Galileo went to visit Bellarmine to receive his injunction in 1616. As a Dominican, Seghizzi may not have trusted Bellarmine to explain Galileo's error in strict terms. According to Drake, "by the time the Cardinal had finished his admonition, the Commissary was ready. Without allowing Galileo time for any reply, he proceeded to deliver his own stringent precept not to hold, defend, or teach Copernicanism in any way, orally or in writing, on pain of imprisonment" (*ibid*: 145). This was duly recorded by a notary and became the (unsigned) document that Maculano questioned Galileo about. Upset with the way Seghizzi had behaved, Bellarmine then met with Galileo subsequently following the latter's complaints that people were gossiping about his having been silenced. Telling him to discount what he had been told by Seghizzi, who had overstepped his bounds (although Fantoli, 1996: 260 disagreed on this point), Bellarmine wrote a certificate of *exactly* what he had said to Galileo and then signed it (XIX, 348). This is the second document, which Galileo produced at his interrogation and which no one but he knew of until that time.

On this version of events, Galileo had indeed been ordered not to "hold, teach, or defend [Copernicanism] in any whatever, either orally or in writing", but in an extrajudicial manner. His instructions from Bellarmine, on the other hand, *did* allow him to treat of Copernicanism in a suppositional way. In any case, the coexistence of these two statements caused a great deal of consternation for Maculano and the Commission. It was easy to see that the signed certificate from Bellarmine outweighed the unsigned notary's paper but it was simply not possible to leave Galileo unpunished because the "Holy Office had itself brought the charges, and in theory at least, a false charge of heresy carried the same penalty as heresy itself" (*ibid*: 149). There was also the matter of whether Galileo had transgressed the instructions given to him by Bellarmine, irrespective of which of the papers was an accurate record of what had occurred on that day in 1616. In spite of Galileo's protestations of innocence, which he later dropped (XX, 361-362), it was obvious that he had written the *Dialogue* in such as way as to leave the reader in no doubt as to which was the more reasonable worldview. There was a case to answer.

Maculano explained the dilemma the Congregation was faced with late in April:

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*Quote*

In compliance with the commands of His Holiness, I yesterday informed the Most Eminent Lords of the Holy Congregation of Galileo's case, the position of which I briefly reported. Their Eminences approved of what has been done thus far and took into consideration, on the other hand, various difficulties with regard to the manner of pursuing the case and of bringing it to an end. More especially since Galileo has in his examination denied what is plainly evident from the book written by him, as a consequence of this denial there would result the necessity for greater rigour of procedure and less regard to the other considerations belonging to this business. (XV: 252-253)

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He was alluding here to the difficulty caused by the two conflicting documents and the fact that Galileo's denial of defending Copernicanism would have to lead to his trial focusing on this apparent lie to the exclusion of the matter of publishing without permission (according to Urban VIII, at any rate). However, Maculano proposed an alternative:
Finally, I suggested a course, namely, that the Holy Congregation should grant me permission to treat extrajudicially with Galileo, in order to render him sensible of his error and bring him, if he recognises it, to the confession of the same. (*ibid*)

Such an out-of-court settlement would allow the Church to save face in the light of Galileo's certificate from Bellarmine while Galileo himself would be let off with a lesser sentence. Since Galileo was one of the most famous people in Europe and Philosopher and Mathematician to the Grand Duke of Tuscany, it would also be a prudent way to deal with the issue. The latter was pleased with the idea, as Maculano explained:

*Quote*

That no time might be lost, I entered into discourse with Galileo yesterday afternoon, and after many and many arguments and rejoinders had passed between us, by God's grace, I attained my object, for I brought him to a full sense of his error, so that he clearly recognised that he had erred and gone too far in his book. And to all this he gave expression in words of much feeling, like one who experienced great consolation in the recognition of his error, and he was also willing to confess it judicially. (*ibid*)

As a result of this discussion, Galileo was interrogated for a second time on the 30th of April. Having reconsidered the matter, he said, he had re-read his *Dialogue*, checking whether "against my purest intention, through my oversight, there might have fallen from my pen not only something enabling readers or superiors to infer a defect of disobedience on my part, but also other details through which one might think of me as a transgressor of the orders of the Holy Church" (quoted by Finocchiaro, 1989: 277-279). Of course, it turned out that "it appeared to me in several places to be written in such a way that a reader, not aware of my intention, would have reason to form the opinion that the arguments for the false side, which I intended to confute, were so stated as to be capable of convincing because of their strength, rather than being easy to answer" (*ibid*). Galileo's explanation for this conduct was that he had "resorted to that of the natural gratification everyone feels for his own subtleties and for showing himself to be cleverer than the average man, by finding ingenious and apparent considerations of probability even in favour of false propositions" (*ibid*). Shortly thereafter he added that he would gladly write a sequel to the *Dialogue* in which he would confute Copernicanism thoroughly.

This was not what Maculano had hoped for and certainly not enough to satisfy the Congregation. Nevertheless, Galileo was given leave to return to the Tuscan Ambassador's residence owing to his ill health, where he would prepare his defence for the eventual trial at which his plea bargain would be entered. Declining the eight days he was allowed for this purpose, he presented the story of his discussions with Bellarmine and the events leading to the presentation of his signed certificate.

Nothing seemed to happen for many days thereafter, but behind the scenes the situation was deteriorating rapidly. On the 16th of June a document was provided to the Congregation called *Contra Galileo Galilei* (IX, 293-295). It contained the accusations of Lorini and Caccini of 1615 and 1616 respectively, together with "grossly inexact" (Fantoli, *op cit*: 438) details of many of the important events we have covered. It is doubtful that the trial could have been concluded any other way, however, even without these deceitful tactics on the part of some unknown persons. At the meeting of the Congregation on the same day the Pope's decree was
that said Galileo being interrogated on his intention, even with the threat of torture, and, si sustinuerit [*thereafter*, according to Fantoli (*ibid*: 478)], he is to abjure [under vehement suspicion of heresy] in a plenary session of the Congregation of the Holy Office, then to be condemned to imprisonment at the pleasure of the Holy Congregation, and ordered not to treat further, in whatever manner, either in words or in writing, on the mobility of the Earth and the stability of the Sun; otherwise he will incur the penalties of relapse. The book entitled *Dialogue of Galileo Galilei the Lincean* is to be prohibited. (XIX, 283)

Niccolini again met with Urban VIII to try to achieve some form of compromise but was told that the decision had been made. Maculano's attempt at a plea bargain had extracted a "confession" that was not considered adequate, so the only concession that Niccolini could win was a promise that the Pontiff would discuss later how to minimise the suffering Galileo would have to endure (XV, 160).

On the 21st of June Galileo arrived again at the Holy Office for his final interrogation. He repeated that he did not hold the Copernican opinion and that he had "not held it since the decision of the authorities" (XIX, 361-362). When it was pointed out to him, again, that his *Dialogue* gave a contrary impression, he repeated his disavowal. Finally, warned that if he did not speak the truth then recourse might be made to torture, Galileo stated once more that he had not "held this opinion of Copernicus since the command was intimated to me that I must abandon it; for the rest, I am here in your hands—do with me what you please" (*ibid*).

The next day, Galileo was led to the convent of Minvera to another plenary session of the Holy Office, clad in penitential clothes. After reviewing the circumstances of the case, the closing section of the condemnation read thus:

> We say, pronounce, sentence, and declare that you, the said Galileo, by reason of matters adduced in trial, and by you confessed as above, have rendered yourself in the judgement of this Holy Office vehemently suspected of heresy, namely of having believed and held the doctrine which is false and contrary to the sacred and divine Scriptures—that the Sun is the centre of the world and does not move from east to west and that the Earth moves and is not the centre of the world; and that an opinion may be held and defended as probable after it has declared
and defined to be contrary to the Holy Scriptures; and that consequently you have incurred all the censures and penalties imposed and promulgated in the sacred canons and other constitutions, general and particular, against such delinquents. From which we are content that you be absolved, provided that first, with a sincere heart and unfeigned faith, you abjure, curse, and detest before us the aforesaid errors and heresies and every other error and heresy contrary to the Catholic and Apostolic Roman Church in the form prescribed by us for you.

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And, in order that this your grave and pernicious error and transgression may not remain altogether unpunished and that you may be more cautious in the future and an example to others that they may abstain from similar delinquencies, we ordain that the book of the "Dialogue of Galileo Galilei" be prohibited by public edict.

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We condemn you to the formal prison of this Holy Office during our pleasure, and by way of salutary penance we enjoin that for three years to come you repeat once a week the seven penitential Psalms. Reserving to ourselves liberty to moderate, commute, or take off, in whole or in part the aforesaid penalties and penance. (XIX, 402-406)

His hopes crushed completely, Galileo could do no more than read the required abjuration:

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I, Galileo, son of the late Vincenzio Galilei, Florentine, aged seventy years, arraigned personally before this tribunal and kneeling before you Most Eminent and Reverend Lord Cardinal Inquisitors-General against heretical pravity throughout the entire Christian commonwealth, having before my eyes and touching with my hands the Holy Gospels, swear that I have always believed, do believe, and by God's help will in the future believe all that is held, preached, and taught by the Holy Catholic and Apostolic Church. But, whereas—after an injunction had been judicially intimated to me by this Holy Office to the effect that I must altogether abandon the false opinion that the Sun is the centre of the world and immovable and that the Earth is not the centre of the world and moves and that I must not hold, defend, or teach in any way whatsoever, verbally or in writing, the said false doctrine, and after it had been notified to me that the said doctrine was contrary to Holy Scripture—I wrote and printed a book in which I discuss this new doctrine already condemned and adduce arguments of great cogency in its favour without presenting any solution of these, I have been pronounced by the Holy Office to be vehemently suspected of heresy, that is to say, of having held and believed that the Sun is the centre of the world and immovable and that the Earth is not the centre and moves.

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Therefore, desiring to remove from the minds of your Eminences, and of all faithful Christians, this vehement suspicion justly conceived against me, with sincere heart and unfeigned faith I abjure, curse, detest the aforesaid errors and heresies and generally every other error, heresy and sect whatsoever contrary to the Holy Church, and I swear that in future I will never again say or assert, verbally or in writing, anything that might furnish occasion for a similar suspicion regarding me; but, should I know any heretic or person suspected of heresy, I will denounce him to the Holy Office or to the inquisitor or Ordinary of the place where I may be. (XIX, 406-407)
Fantoli (op cit: 446-450) has shown that the juridical position taken against Galileo "can be viewed as fully justified according to the regular practice of the Inquisition at that time, on the basis of the doctrinal and disciplinary decisions of 1616" (ibid: 450). He had denied that he wished to defend Copernicanism when it was plain that he had done so, even if only showing it to be probable; he had defended in the Dialogue a theory that had been declared contrary to Holy Scripture by the decree of 1616; and he had disobeyed the orders given to him by both Bellarmine and Segizzi. "Vehemently suspected of heresy" (but not heretical, a considerably worse charge that, quite correctly, was not brought because it could not be sustained), the only option for the Congregation was to impose an abjuration.
The Galileo Affair, Part 5: The aftermath

By Paul Newall (2005)

Consequences

So it was that the trial and its inevitable result established what had already been determined in 1616 by Bellarmine's blinkered approach, wherein he claimed that no Scriptural passage could be challenged by physical arguments because they all came from the Holy Spirit. This opinion, followed to the letter, would kill science before it had even developed.

As Fantoli put it, "to hold that the provisions of 1616 were only intended to break the untimely zeal of Galileo for Copernicanism without blocking further careful scientific research on the matter appears to me to be completely untenable" (op cit: 481). Although there were other factors, the effect on Copernican astronomy within Italy was catastrophic. Galileo blamed the Jesuits (XIV, 116-117, for example) and there is little doubt that a varied group of opponents was arrayed against him, from jealous academics to furious theologians. Nevertheless, the decisive influence was Urban VIII, convinced that Galileo had betrayed him—without which certainly even the most strident efforts of Galileo's detractors could not have borne fruit.

The complex tale that is the Galileo affair cautions us not to make simplistic judgements. Nevertheless, it remains the case that the question of whether or not Galileo had any proof for Copernicanism was never at issue—in 1616 or in 1633. The very possibility of any demonstration was excluded in principle by Bellarmine's doctrinal position and its adoption by an authoritarian Church. The trial and abjuration of Galileo thus represented an "institutionalised abuse of power which can never be sufficiently deprecated" (ibid), in which the societal position of the Church was used to dictate the correct understanding of an issue that was never considered on its own terms. Allowing the enmity of some philosophers to provoke a theological confrontation when there was only a physical argument at issue, the machinery of the Holy Office was turned against Galileo and fell into the very error he and Augustine before him had warned against.

In spite of Galileo not being blameless himself, it is fair to say that history has judged the Church justifiably harshly—most notably, perhaps, Pope John Paul II with his comment on the Galileo affair that "the sons and daughters of the Church must return with a spirit of repentance ... [to] the acquiescence given, especially in certain centuries, to intolerance and even the use of violence in the service of the truth" (1994: 45). The upshot of the affair was characterised by Westfall when he explained that

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[as the Church had remained a central factor in European life for more than fifteen hundred years by refusing ever to put itself in opposition to prevailing learning, so it would remain a factor in the new age then being formed if it refused to be at odds with modern science. The net result of Cardinal Bellarmine's devoted effort to defend his Church was to place an incubus to its back that it struggles still to shake off. (op cit: 24)

For his part, Galileo had seen his attempt to save his Church from this mistake crushed by the authoritarianism he had sought to delimit to theology. Writing in 1633 to his friend Diodati of yet another attack on Copernicanism...
by Libert Froidmont, he asked

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[w]hen Froidmont or others have established that to say the earth moves is heresy, while demonstrations, observations, and necessary conclusions show that it does move, in what swamp will he have lost himself and the Holy Church? (XV, 25)

It seems the question could only be rhetorical.

Galileo was imprisoned by the Holy Office but his sentence was commuted—first to confinement within the Tuscan Embassy, then to house arrest in the Archbishop of Sienna's residence, and finally to house arrest in his own villa at Arcetri, close to Florence in his native Tuscany (XIX, 389). This circumstance remained in force even when he was completely blind. Using dictation to his students, however, he continued to work despite his disappointment, compiling all the work he had done or intended to do on dynamics. This was published in 1638 in Leiden as the Discourses and Mathematical Demonstrations about two new sciences belonging to Mechanics and local motions.

On the 8th of January, 1641, his health having deteriorated for the last time, Galileo Galilei died with his son Vincenzio and his student Evangelista Torricelli at his bedside. He was buried in the church of Santa Croce in Florence, the Grand Duke resolving immediately to "provide a sumptuous tomb for him comparable to and facing that of Michelangelo Buonarroti" (XVIII, 378). The Tuscan Ambassador was told by Urban VIII in Rome that this could not possibly be allowed (*ibid*, 378-379), showing that the attitude of the Church to him did not soften following his death. His friends, at least, realised his true stature and how he would be considered by posterity
Only in 1734 did the Church finally give permission for a mausoleum to be built for Galileo's remains (XIX, 399), which were moved to the completed structure in 1736. The inscription read Galileo Galilei, Florentine Patrician, very great Innovator of Astronomy, of Geometry and of Philosophy. Incomparable to anyone of his time. May he rest here well. The work that Galileo had begun with the Two new sciences had since been completed by Newton in his Principia Mathematica and the Church finally had to come to terms with what Bellarmine supposed there could not be—a justification of Copernicanism.

The adaptation was still slow, with the 1741 authorised edition of Galileo's works still requiring "corrections". In 1757 the decree of 1616 was quietly dropped from the Index of forbidden books, but the Copernican works proscribed therein remained until 1822 "out of at having finally to take a clear position with respect to the behaviour of the Church" (Fantoli, op cit: 497). In perhaps the ultimate irony, Pius VII released a decree in 1822 stating that no work treating of the motion of the Earth was to be prohibited, on pain of punishment for the person proposing to do so—a complete reversal of the situation in 1616 and 1633.

The Galileo Affair Today

In the nineteenth century the rise of anti-clericalism and its antithesis in the combative defenders of the Church led to the myths we began this essay with. For the former, Galileo was a martyr to intellectual freedom, having fought the dragon of implacable hostility to science and free thought. No more convincingly, for the militant supporters of the Church Galileo embodied vanity, pride and ambition, and was responsible for his own sufferings at the hands of a Church that had correctly judged the limits of the available knowledge and acted accordingly. Neither of these can be taken seriously today, as we have seen.

In 1849 the archives of the Holy Office were opened for the first time for the study of the Galileo affair. Giacomo Manzoni, Minister of Finances of the short-lived Roman Republic, and Silvestro Gherardi, Minister of Public Education, found some of the relevant documents and published them as The Trial of Galileo Reseen through Documents from a New Source in 1870. With the return to power of Pius IX, the Church hastily compiled its own resource to prevent any possible damage, with Prefect of the Secret Vatican Archive Marini's Galileo and the Inquisition issued in 1850. This was—intentionally—nothing approaching a complete record of the affair. Several other scholars were later given the chance to consult the volumes on Galileo, including Henri de L'Espinois, Domenico Berti and Karl von Gebler. In 1880 the Secret Archives were finally opened by Leo XIII and Antonio...
Favaro began his work on the *National Edition of the Works of Galileo*. Nevertheless, a resolution of the difficulties posed by the Galileo affair was no closer.

In 1941 a decision was made by the Pontifical Academy of Sciences to commission a biography of Galileo in time for the 300th anniversary of his death in 1942. The work was entrusted to Monsignor Pio Paschini, professor of Church history in Rome at the Pontifical Lateran University, which he duly completed (slightly late) within three years. The book was rejected, however—some said for the harshness of opinion Paschini demonstrated towards the Jesuits for their part in the affair—and only released some twenty years later, having been corrected for the "inappropriate" way it portrayed the Church (cf. Maccarrone, 1980 for more detail). Thus did the concern to "save face" extend all the way to the Second Vatican Council and beyond.

On the 10th of November, 1979, Pope John Paul II gave an address at the Pontifical Academy of Sciences in celebration of the 100th anniversary of the birth of Einstein, at which he noted that

> The greatness of Galileo is known to everyone, like that of Einstein; but unlike the latter... the former had to suffer a great deal—we cannot conceal the fact—at the hands of men and organisms of the Church. ... I hope that theologians, scholars and historians, animated by a spirit of sincere collaboration, will study the Galileo case more deeply and, in a loyal recognition of wrongs from whatever side they come, will dispel the mistrust that still opposes, in many minds, a fruitful concord between the Church and the world. I give all my support to this task, which will be able to honour the truth of faith and of science and open the door to future collaboration. (quoted in Bucciarelli, 1980: 79)

This challenge was taken up with the formation in July 1981 of a "Galileo Commission" under the leadership of Cardinals Casaroli and Garrone and split into four areas: exegetical; cultural; scientific and epistemological; and historical and juridical. A series of works were produced, beginning in 1983 and culminating in the *Studi Galileiani* of the Vatican Observatory.

On the 31st of October, 1992, the Pope again addressed the Pontifical Academy to draw to a close this period of investigation. Commenting on the whole affair, his talk took a different tack when he said that

> From the beginning of the Age of Enlightenment down to our day, the Galileo case has been a sort of myth, in which the image fabricated out of the events was quite far removed from reality. In the perspective, the Galileo case was the symbol of the Church’s supposed rejection of scientific progress, or of dogmatic obscurantism opposed to the free search for truth. This myth has played a considerable cultural role. It has helped to anchor a number of scientists of good faith in the idea that there was an incompatibility between the spirit of science and its rules of research on one hand and the Christian faith on the other. (in 1992: 271-280)

The Pontiff went on to explain that the affair had resulted from a "tragic mutual incomprehension", which consisted in four separate conclusions of the Commission:

- Galileo failed to appreciate that he had no *proof* of Copernicanism;
- Theologians of that time did not correctly understand Scripture;
Bellarmine truly understood what was "at stake" in the affair; and
The Church accepted Copernicanism as soon as proof was available.

We have seen that the first of these is untenable. The second fails because the methodological principle of Galileo's Letter to the Grand Duchess, while commonplace today, was neither understood nor employed by theologians at that time; and so it is useless to complain that it was not wielded correctly. We have also noted that Bellarmine's position rendered any such accommodation impossible. Following on from this, the third we already know to be in error: Bellarmine's position was not instrumental at all but based on reading all Scriptural passages as literally coming from the Holy Spirit. Finally, the idea that the Church embraced Copernicanism as soon as it was demonstrated is given the lie by the unwillingness to open the Secret Vatican Archives and the fact that the 1744 edition of Galileo's works was not allowed to contain the Letter (although it did include the Dialogue, but only with the sentence of 1633 alongside it) (Coyne, 2002), as we have treated of briefly above.

Thus we see that the Church had retreated from the boldness of John Paul II's intentions in 1979 to a restatement of the old myths we have considered and rejected throughout. Meanwhile, Galileo studies continue unabated with new perspectives continually casting the affair in a different light. It is perhaps in this desire to consider the case closed that the contemporary Church has erred most seriously, since the continuing relevance of all the issues encompassed by this great human, theological, philosophical, political and personal drama is such that it seems likely to maintain its hold over our imaginations indefinitely. It is as well to leave the last word on a subject that is never final, then, to Fantoli (1996: 511), who suggested that:

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References:

(Note: Links do not necessarily refer to the same edition.)

- Mario Biagioli, The Social Status of Italian Mathematicians, 1450—1600, in History of Science 27, 1989, 41-95
- Mario Biagioli, Galileo Courtier (Chicago: University of Chicago Press, 1993)
- Berthold Brecht, Galileo (New York: Grove Press, 1966)
- Brenno Bucciarelli, Speech of His Holiness John Paul II, in Einstein Galileo (Vatican City State: Libreria Editrice Vaticana, 1980)
- Nicholas Copernicus, De revolutionibus orbium celestium (Chicago: Great Books, 1953)
- G.V. Coyne, The Church's Attempts to Dispel the Galileo Myth (Galileo and the Church—an International Conference: University of Notre Dame, 18-20 April 2002)
- Stillman Drake, *Essays on Galileo and the History and Philosophy of Science* in three volumes (Toronto: University of Toronto Press, 1999)
- Stillman Drake, *Discourses and Opinions of Galileo* (Garden City, NY: Doubleday, 1957)
- Pierre Duhem, *Essai sur la notion de théorie physique de Platon Galilée*, translated as *To Save the Phenomena* by Doland and Maschler (Chicago: University of Schocago Press, 1969)
- George Ganss (trans.), *The Constitutions of the Society of Jesus* (St. Louis: Institute of Jesuit Sources, 1970)
- Alan Musgrave, *The Myth of Astronomical Instrumentalism*, in Mun var (ed.), *Beyond Reason* (Dordrecht:
Kluwer, 1991)