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WHITE PAPERS

GALILEO AND THE ARISTOTELIAN CARDINALS: A STUDY OF SUPPRESSION

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ABSTRACT

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This study re-examines the famous trial of Galileo by framing it in its historical context and then examining the rhetoric of Galileo in his famous *Dialogue on the Two Systems*. The study demonstrates that censorship of Galileo retarded scientific development. It also revises history to show that the animosity of Pope Urban VIII was not the only cause of Galileo's being brought before the Holy Office. First, Cardinals favorable to his position were overwhelmed by the Aristotelian Cardinals seeking preserve church doctrine during the Thirty Years War. Second, Galileo developed a false sense of security because of the freedom he enjoyed in Venice and Padua, because of the professed friendship of the Pope, because he believed he would be protected by the Medicis, and because his *Dialogue* has been approved by two boards of Inquisitors. Third, his vitriolic rhetoric offended his colleagues, his peers, and the Pope.

GALILEO AND THE ARISTOTELIAN CARDINALS: A STUDY OF SUPPRESSION

In Rome on a very hot August 13th, 1600, Giordano Bruno, a Dominican Friar, was burned at the stake for endorsing Nicholas Copernicus' heliocentric theory and claiming that Christ was not divine. The smoke from the immolation spread a pall over the scientific community. Prior to Bruno's martyrdom, the philosopher Patrizi had been forced to recant his Platonism. The works of Dante, Telesio, Charron, and Campanella were put on the Catholic Church's Index of forbidden books. The deluge of attacks on heresy was a reaction to the Protestant reformation; it would swamp Galileo Galilei, and demonstrate how the pope could retard scientific discovery.

This study will proceed in several stages. First, it will provide the historic context to Galileo's trial by following the incorporation of Aristotelian thought into Catholic orthodoxy. Second, it will examine the relationship between church censorship and science by examining the argumentation of Galileo's famous *Dialogue on the Two Chief Systems*, for which he was brought to trial. Third, it will re-evaluate Galileo's sentencing in light of the contextual and argumentative reading of his work.

By the time of Galileo's birth, the papacy had re-established its hold over the church, having weathered Martin Luther's revolt. Cardinal Caraffa, who became Paul IV, put a counter-reformation in place. He created the "Holy Office," which took up investigations of church matters in all of the known Catholic world. Caraffa's attack on immorality is credited with re-establishing moral leadership among Catholics, though by this time England had fallen away due to the defection of Henry VIII.

As the war between Catholics and Protestants raged, the popes became more concerned than ever about heresy. The devout Bernardino Ochino, who founded the Capuchin order, refused a call to Rome, fearing for his life, and retreated to Protestant Geneva for safe haven. Followers of Erasmus were silenced and his books put on the Index. After some turmoil (see below), the Dominicans and Franciscans had adopted Aristotle, particularly his method of argumentation, as their guide, after aligning some his claims with scripture. The incorporation of Aristotle would be important to the story of Galileo since the Franciscans, the Dominicans, and the Jesuits were for the most part were devout Aristotelians. Their initial love for Aristotle's *Organon* carried over to his work in the sciences, some of which was badly flawed. Since Galileo's findings would undercut some of Aristotle's scientific claims, he would come into the sites of the Aristotelians in the Catholic Church.

THE RISE OF ARISTOTELIANISM IN THE CATHOLIC CHURCH

Since Aristotle was considered a pagan, he was not initially embraced the church. As late 1300, one could find strong resistance in the Catholic Church to teachings of Aristotle. However, just as Augustine had incorporated Plato and Cicero into church teachings, thereby overturning Tertullian's injunction against them, so too would later church scholars incorporate Aristotle's works. The Christian Boethius translated the *Organon* while serving Theodoris as Master of Offices. He began the "scholastic" tradition of relying on reason to support Biblical interpretations. The monk Abelard relied on Aristotle's Categories to refine his argumentation. He was fascinated with Aristotelian dialectic, and incorporated it into the *logica modernorum* of the time.^[1] However, Abelard's controversial life style retarded the spread of Aristotelian teachings within the church. In 1179, another hurdle was placed before Aristotelians when in reaction to the Cathar heresy, the Third Lateran Council called on the faithful to take up arms against heretics. The Cathars were experts at using Aristotle to defend their positions.^[2] Some in the church were smart enough to realize that they too could use Aristotle in defense of their positions. Pope Innocent III ordered Domingo de Guzman, the founder of the Dominican order, to do battle with the Cathars, and he proved their equal by using their Aristotelian dialectic. Soon all of Aristotle's works that were extant, including those found in the Muslim strongholds of Spain,^[3] were being examined in Rome and at the universities of Paris and Bologna, which enjoyed more academic freedom than their counterparts in Byzantium. The *Physics* proved to be one of the most popular with its definition of an "unmoved mover" and its depiction of the earth as the center of the universe. However, it would be an uphill battle

for Aristotelians. In 1210 a council of bishops banned Aristotle's works in Paris on penalty of excommunication.^[4] That allowed the University of Padua, founded in 1222, where Galileo would eventually teach, to advertise that it was a place where Aristotle could be studied.

Perhaps the most important reversal in church thinking on the matter occurred in 1231 when Pope Gregory IX restored the right to explore Aristotle's works in Paris under strict supervision. From Paris, Aristotelianism would spread across Europe under the guise of being corrected commentary on the great philosopher. Thomas Aquinas, a Dominican, played no small part in this conversion, arguing through Aristotelian demonstrations that reason came from God and could lead us back to God as the ultimate cause of all creation. As a student of Albert the Great, Aquinas had become familiar with all of Aristotle's major works and attempted to reconcile them with Christian theology. He returned to Paris in 1252 where he met Bonaventure; the two were able to convince the University of Paris to require Aristotelian studies of all undergraduates. Thus, what Augustine was to Platonic thought, Aquinas was to Aristotelian thought. His commentary on Aristotle's Politics had been widely circulated by the end of the 13th century. For our purposes, it is interesting to note that the commentary endorses public participation in government.

Despite a set back 1270, when once again the Bishop of Paris forbade the teaching of Aristotle, Aquinas' *Summa Contra Gentiles* set a new standard for the use of Aristotelian demonstration in defense of the faith. He also used his logical machine—Aristotle corrected by scripture—to defend his notion of free will. Again, the church balked issuing the Condemnations of 1277, which listed over 200 Aristotelian statements that were incorrect. Some of these statements came directly from Aristotle's *Physics*.

Despite these injunctions, the Dominicans continued to use Aristotle as the basis of the teaching in their universities. When they secured the canonization of Aquinas in 1323, Aristotelianism was reinforced. The condemnations and bans were rescinded in Paris. Its university sought to catch up with the University of Padua in terms of scholasticism.^[5] In the meantime, the Franciscans, relying in part on Duns Scotus and William of Ockham, found their own way to Aristotle.^[6] While Aquinas sought to define the role of reason in nature, Scotus and Ockham opened the door to empirical science with their focus on knowable facts, though Ockham had to battle charges of heresy along the way. Like Luther, Ockham needed the protection of a political prince. Once he found him, Ockham's speculations were safe. His story may have caused Galileo to believe that he was protected while under the Medici roof. What Galileo needed to understand, however, was that for most of the two centuries leading up to his discoveries, Aristotelianism dominated the curricula of Europe despite the incessant in-fighting between Dominicans and Franciscans. He also needed to understand that the Catholic Church had recently been traumatized by the Avignon captivity of the popes and the great schism in the church of 1378 to 1417. From his protected perch, Ockham claimed these popes were heretics. To end the schism, the College of Cardinals deposed all claimants to the papacy and installed Martin V as the new pope. As a result of this turmoil, when the popes returned to Rome, they fortified and isolated themselves at Castel Sant' Angelo. It was during this time that the Vatican area emerged as their private, secure state.

GALILEO'S REVOLUTION

Several scholars inspired Galileo's scientific investigations. Aristotle's theory had been refuted by Claudius Ptolemy, and then revised by Copernicus when he published *De revolutionibus* in 1543, which he dedicated to Pope Paul III. Paul had condoned the re-activation of the Inquisition in Italy, half a century after the Inquisition had been re-ignited in Spain by Ferdinand and Isabella. In fact, in Italy prosecutions were carried out with even harsher results.^[7] With the exception of martyred Giordano Bruno, the Dominicans joined with Franciscans to enforce orthodoxy and prevent compromise with the Protestants. Ignatius Loyola, who founded the Jesuits in 1540, made loyalty to the "Hierarchical Church" its first rule of obedience. The Jesuits, having studied Aquinas, became superb logicians on the front lines of the Counter Reformation. They knew that Luther had condemned Aristotle: "Aristotle is to divinity, as darkness is to light," he had said.^[8] Nothing strengthened Aristotle's position in the Catholic Church more than Luther's condemnation of him and the scholastics that had advanced his theories.

The pope also contributed men to fight for Holy Roman Emperor Charles V in the Thirty Years War, which would create a context for the trial of Galileo. The Council of Trent, which ended in 1563, also played a role in Galileo's trial because the Council reinforced the influence of Aristotelian scholasticism on Church doctrine, making it more rigid than ever. Luther's teachings were condemned; Jerome's *Vulgate* endorsed as the only true Bible. Paul IV, who endorsed the conservatives in his bull *Benedictus Deus*, lectured on what constituted proper art, and revised the *Index of Prohibited Books*.

Into this context was born Galileo Galilei (1564-1642), a renaissance man, who had memorized epic Italian poems while being educated at the University of Pisa near his home town.^[9] He entered that university in 1581 to study medicine, but soon shifted his studies to mathematics. He then taught in Florence before returning to the University of Pisa in 1589 as professor of mathematics, where he learned that Tuscany, because of political past, was enmeshed in vitriolic dialectic that carried over into the academic community.^[10] Nonetheless, he began to study Copernicus and also undercut Aristotle's theory concerning falling objects. Galileo's contract was terminated when he indicated his support for heliocentrism and argued that the earth rotated on an axis. In 1592, the University of Padua, under the control of Venice, hired Galileo; there, he studied Tycho Brahe's theories of astronomy. By 1597 he was an avid empiricist and Copernican, a position reinforced by his study of pendulums in 1602.^[11] Galileo's time in Venice is important because that city was much more tolerant of dissent than other city-states. In fact, Venice considered itself a counter-weight to Rome both politically and in terms of religious toleration. This may be why Galileo would set his controversial dialogues in the city of Venice, which had long been a stellar republic surrounded by monarchies. When Venice led the defeat of the Turks at Lepanto, the city became more independent of the papacy than ever. Venice claimed that it was the savior of Christendom. Prior to Galileo's arrival in Venice, popes had been hostile to the city because of its independence. In fact, Julius II won a war against Venice and the city state regularly allied itself with enemies of the popes. Pius V and Gregory XIII were suspicious that the sea-faring Venetians were regularly exposed to heresy. These popes named no cardinals from the city during their tenures. Like other popes, these two made Florence their political favorite. Thus, Galileo's association with Venice may have hurt his reputation with the papacy while instilling a false sense of security about how his theories would be received.

In 1604, an observation would provide Galileo with evidence for an anti-Aristotelian argument. Galileo saw a

supernova and began to doubt Aristotle's theory concerning the permanence of the heavens. Galileo raised eyebrows when he wrote a comic dialogue in the vernacular between two peasants who ridiculed Aristotelian science. This argumentative technique was a favorite of the time^[12] and Galileo would return to it again. The problem was that it tended to harden the hearts of his opponents.

Galileo was familiar with the works of Ludovico Carbone and Antonio Riccobono.^[13] The latter provided a new commentary on Aristotle's *Rhetoric*. Carbone wrote on many subjects, but it may have his *On Oratorical and Dialectical Invention* that caught Galileo's attention. Because of the give and take between Protestants and Counter-Reformation forces within the Catholic Church, argumentation enjoyed a resurgence. Along the canals of Venice, publishing houses turned out many of these books. Galileo adopted the style of argumentation used in many of them.

More importantly, Galileo soon supported Copernicus's theory with empirical evidence observed from his newly invented telescope. As the powers of the telescope were increased, Galileo could see ships at sea hours before harbor masters could and thus, he became a consultant to the Venetian Navy.^[14] Smartly, he made a gift of his new invention to the Venetian Senate in 1609, and the sea power rewarded him with tenure at Padua. He was an academic success who felt comfortable advancing his controversial thesis.

A year later, Galileo was called home to Tuscany at the request of his former pupil Cosimo de Medici II, who had become Grand Duke. At the University of Pisa, which reported to the Medici, Galileo discovered the isochronism of the pendulum using his own pulse. In September of 1611, he engaged Aristotelians in a debate that was hosted by the Grand Duke and observed by two visiting Cardinals, one of whom was Maffeo Barberini, who eventually became Pope Urban VIII. Barberini believed Galileo had won the debate and came to admire the physicist, yet another factor that created a false sense of security in the scientist.^[15] It gave him the courage to display his telescope to the papal court, where he was made a member of the Roman Accademia dei Lincei, one of the first learned societies. He was feted by important Cardinals including Barberini. During this visit, Galileo also met with Pope Paul V, who had resisted reform, had further fortified the Vatican, and had excommunicated the entire Venetian senate because it had imposed taxes on church property. Nonetheless, Paul treated Galileo as a royalty. Galileo's success led to jealous backbiting on the part of his academic colleagues in Florence and Pisa.

In 1612, Galileo successfully predicted the eclipses of the moons around Jupiter; he then further verified Copernicus' theory using the phases of Venus, based on tip from Benedetto Castelli.^[16] He went on to write a thesis on the center of gravity in solid bodies and to invent a hydrostatic balance theory that correctly revised Archimedes. Galileo's work *Bodies in Water* was published in the vernacular and again challenged Aristotle's physics. Galileo's book prompted Cardinal Carlo Conti to assure Galileo that the Bible did not support Aristotle's physics and astronomy. The book further roiled Galileo's colleagues. Worse, the Dominicans in Florence condemned Copernicus in the same year.

Galileo soon provided his new Medici patron with a treatise on Jupiter called *The Starry Messenger*; Galileo had discovered four moons circling the huge planet. Galileo's observations allowed him to put natural law into mathematical formulas, a procedure that would greatly advance the scientific method and become the basis of modern mechanics. Since Venice was more tolerant of new ideas than either Florence or Rome, the book was published there and eventually found its way into the hands of Johannes Kepler (1571-1630), who would help in the struggle to get Copernicus' theory accepted.

In 1613, when he wrote his treatise on sun spots, he re-confirmed Copernicus' theory. Galileo challenged Aristotle's theory that bodies can remain in motion only if there is some force acting on them; Galileo argued that no such force was necessary once the body was set in motion. This was the primitive notion of inertia that would inspire Isaac Newton, who was born in the year that Galileo died.

These new theories raised so much suspicion and controversy that Galileo felt obligated to write a letter to a pupil who had offended the Grand Duchess Christina of Lorraine by defending Galileo's teaching. In the letter, he explained that nothing he wrote or taught was meant to suggest that the scriptures were in error. However, Galileo allowed that the Bible was metaphorical and often adapted to the common wisdom of its time for rhetorical effect. This letter had been widely circulated by the end of 1614. It provides the first indication that Galileo was aware of the possibility that he might be charged with heresy. In Florence, Galileo might have been alerted to certain danger when he was condemned from the pulpit of Santa Maria Novella as a heretic; but church officials quickly apologized for the rants of the Dominican friar who attacked Galileo.^[17] In the meantime, Galileo's letter made its way to an inquisitor. By 1615, Galileo had written an apologia addressed to the Grand Duchess, in which he stated "... the increase of known truths stimulates investigation, establishment, and growth of the arts."^[18] Galileo used an array of church saints to defend his investigations, an argumentative strategy he would wish he had retained in later life.

Amidst the growing controversy, Galileo traveled to Rome to try to clear his name. While there, he wrote his theory of tides at the Medici villa in 1616, arguing that the rotation of the earth creates a sloshing in the ocean that causes tidal changes. Newton, among others, would correct this theory explaining the gravitational pull of the moon. But at the time, Galileo received a serious warning from the Aristotelian Cardinals surrounding the papacy. He therefore opened a liaison with Pope Paul V through the Medici Cardinal Orsini. The pope convened his counselors to assess Galileo's new theory. The leader of this group was Cardinal Roberto Bellarmino, a conservative Medici, but an admirer of Galileo's nonetheless. He brought Galileo the bad news. Heliocentrism was condemned and Galileo was told to only speak about it as a hypothetical theory. Bellarmino put his understanding of the case into a letter to Galileo. It would play an important role in his trial years later.

Matters seemed to go from bad to worse when, on March 5, 1616, Copernicus' work was put on the Index. Six days later the pope met with Galileo to receive his apologia. Luckily, Paul V believed Galileo to be sincere and allowed his return to Florence.

In 1618, Galileo was too ill to view the comets that streaked through the skies over Florence. However, a year later, he published his theory of comets through one of his students. He may have done this because the treatise attacked two Jesuit scientists. Galileo's ruse did not work. The priests immediately determined that Galileo had written the paper; they published rebuttals to it. Galileo then responded in his own name. By 1620, this debate had caught the attention of the pope, who wanted assurance that no mention of Copernicus was made. By this time, it was clear that Galileo

was fond of three types of argumentation to advance his theories. First was empirical evidence out of which he crafted his strongest arguments; second was demonstration in the fashion of Aquinas; third was refutation, often encased in sarcastic dialogues. It was this latter method of arguing that would cause resentment among Galileo's peers, though such diatribes were not uncommon at the time. Thomas Conley has made clear that vituperation was common by Galileo's time, and this too may have given the scientist a false sense of security.^[19]

In 1621, Pope Paul V died and so did Cardinal Bellarmino. Thus, those with a first hand knowledge of the agreement with Galileo on Copernicus' theory were no longer on the scene. In 1622 the short lived Gregory XV was succeeded by Urban VIII, formerly Cardinal Barberini. Delighted, Galileo completed and published his book on comets, *The Assayer*; which he dedicated to the new pope, whom, as we have seen, Galileo had known since 1611 and who, as late as 1620, had addressed Galileo as "your brother."^[20] The pope had the book read aloud at various gatherings. More good fortune shined on Galileo when a student he had mentored, the pope's nephew, was made a cardinal in his own right. This appointment provided Galileo with another powerful ally in the church, which strengthened his false sense of security.

When Urban intimated in his coronation address that he would intensify the church's role in the Thirty Years War, many in the audience felt the chill of censorship sweep through the room.^[21] Urban not only studied under Jesuits but made the canonization of Ignatius Loyola his top priority. Urban knew astronomy and welcomed scholars into his curia on regular basis; but these seminars gave the scholars an opportunity to denounce their rivals, one of whom was Galileo.

None of this seemed to have an affect on the pope. Galileo came to Rome in the Spring of 1624 and met privately with the pope on at least six occasions. In June, the pope wrote of Galileo, "We embrace with paternal love this great man whose fame shines in the heavens and goes on earth far and wide."^[22] Galileo felt secure enough to re-open the Copernican debate in writing. He believed he had an agreement with the pope to clarify the Edict of 1616. The Edict, as Galileo understood it, was aimed not at scientific discovery but at protecting scriptural interpretations made by the Catholic Church. Since Thomas Aquinas' famous dicta on the subject, the church held the position that scripture was superior to science. Where science contradicted scripture, science was simply wrong. Humans were too limited intellectually to work out these contradictions, which the church viewed as illusions. Scriptural interpretations were not to be called into question, but hypothetical speculation could advance.

In 1625, Cardinal Zollern reported to Urban that German Protestants embraced the Copernican doctrine. This aroused the zealous pope to extend the Thirty Years War to science. At the same time, Galileo, assuming the pope was with him, launched a dismissive and arrogant literary shot at Monsignor Francesca Ingoli, a Jesuit. In the paper, Galileo claimed that the pope was his friend and called for the acceptance of Copernicus on a theoretical but non-theological grounds. Galileo's delusion was reinforced when the pope accepted the 50-page polemic, complementing Galileo on a thoughtful piece. This acceptance of Galileo's sarcastic and cutting refutational dialogic method encouraged further use of the same method in his major work.

THE DIALOGUE ON THE TWO CHIEF SYSTEMS

The pope's praise emboldened Galileo to write his fateful *Dialogue on the Two Chief Systems of the World, the Ptolemaic and the Copernican*. It would take six years to complete. While he retained the view that nature is fundamentally based on mathematically determinable shapes, such as triangles, trapezoids, and the like, he demonstrated that Aristotle's theory of mechanics was deeply flawed and that Copernicus was correct in his assessment of the relationship between the sun and the planets.

The work is constructed as a conversation in the vernacular among three learned friends in four settings. Galileo represented Aristotelian thinking in the character Simplicio, an arrogant philosopher who is made to look foolish throughout the *Dialogue*. The character would prove Galileo's undoing when offended Aristotelians around the pope convinced Urban that Simplicio was meant to be the pope himself.^[23]

In the beginning of the *Dialogue*, Galileo differentiated between Ptolemy's and Copernicus' theories. He took the Copernican side in the debate "proceeding as with a pure mathematical hypothesis and striving by every artifice to represent it as superior to supposing the earth motionless."^[24] Note that Galileo tried to abide by the agreement of 1616 by claiming his speculation was hypothetical, but that he intended to use every available means of persuasion to make his point. The former claim was to protect him from prosecution; the latter would get him into trouble because of the abrasive argumentation he used.

For example, he referred to the Aristotelians as "Peripatetics," those who taught in Aristotle's school,^[25] and claimed that "These men indeed deserve not even that name, for they do not walk about; they are content to adore the shadows, philosophizing not with due circumspection but merely from having memorized a few ill-understood principles."^[26] Galileo not only echoed Callicles' attack on philosophy from the *Gorgias*, he insulted his rivals for hypocrisy and ignorance.

In the fashion of Plato, Galileo then turned the argument over to his three characters, Simplicio, Sagredo, and Salviati. In the initial passages and throughout, there are moments when the characters live up to the Platonic ideal of questioning, arguing and seeking the truth. Note the argumentative progression in the following passage:

SAGR. Does not this cannon ball, sent perpendicularly upward by the force of the charge, continually decelerate in its motion until finally it reaches its ultimate height, where it comes to rest? And in diminishing its velocity—or I mean in increasing its slowness—is it not reasonable that it makes the change from 10 degrees to 11 sooner than from 10 to 12? And from 1,000 to 1,001 sooner than 1,002? And, in short, from any degree to a closer one rather than to one more remote?

SIMP. That is reasonable.

SAGR. But what degree of slowness is there that is so distant from any degree of motion that the state of rest (which is infinite slowness) is not still farther from it? Whence no doubt can remain that the ball, before reaching the point of rest, passes through all the greater and greater gradations of slowness, and

consequently through that one at which it would not traverse the distance of one inch in a thousand years. Such being the case, as it certainly is, it should not seem improbable to you, Simplicio, that the same ball in returning downward, leaving rest, recovers the velocity of its motion by returning through those same degrees of slowness through which it passed going up; nor should it, on leaving the larger degrees of slowness which are closer to the state of rest, pass by a jump to those farther away.

SIMP. This argument convinces me.^[27]

However, the argumentation of ridicule is far more typical of the tone of the work. Simplicio, the Aristotelian, appears thick headed because of his inability to argue well. He says, in one passage added after the initial draft, "Please put it down to my lack of practice in the mathematical sciences if I say freely that your arguments are based upon 'greater ratios' and 'lesser proportions' and other terms which I do not sufficiently understand."^[28] Simplicio tries to defend Aristotle's theory of falling weights, which Galileo had discredited while at Pisa:

SALV. That makes no difference at all, for a ball of one, ten, a hundred, or a thousand pounds will all cover the same hundred yards in the same time.

SIMP. Oh, that I do not believe, nor does Aristotle believe it either; for he writes that the speeds of falling heavy bodies have among themselves the same proportions as their weights.

SALV. Since you do not want to admit this, Simplicio, you must also believe that a hundred-pound ball and a one-pound ball of the same material being dropped at the same moment from a height of one hundred yards, the larger will reach the ground before the smaller has fallen a single yard. Now try, if you can, to picture in your mind the large ball striking the ground while the small one is less than a yard from the top of the tower.^[29]

The others characters patronize Simplicio, further reducing his credibility. Sagredo often has to explain what Salviati is saying to Simplicio because Salviati has a superior intellect.^[30] Simplicio is portrayed as "confused and perplexed."^[31] His thoughts are often reworded for him. In exchange after exchange, he is ridiculed but fails to see what is being done to him. For example, when Simplicio affirms Aristotle's opinion that the heavens have an "impenetrable hardness," Sagredo replies, "What excellent stuff, the sky, for anyone who could get hold of it for building a palace!" Salviati chimes in that these are "castles in the air."^[32] At one point, Salviati condescendingly claims that he will help relieve Simplicio's "incredulity."^[33] At another, Salviati says, "Perhaps you had better tell us about it so that Simplicio will not go on thinking your mirth was directed at him."^[34] Simplicio complains on page 158, "Stop your sneering." Salviati accuses Simplicio of being "one of that herd who ... retired into their studies and glance through an index and a table of contents to see whether Aristotle has said anything about them."^[35] Later Salviati continues this line of attack: "It is indeed remarkable to me that Simplicio himself, in granting this assumption ... does not see the enormous absurdity contained in it."^[36] Often, when Sagredo has completed his translation of Salviati's thought for Simplicio, Salviati is allowed to continue. Though this device allowed Galileo to make his point twice, once for the learned, and once for the common reader, it was insulting to Aristotelians.

Salviati directly attacks Simplicio at various points when he loses patience with his lack of argumentative ability: "I am surprised that you should need to have Aristotle's fallacy revealed, it being so obvious, and I wonder at your failure to perceive that Aristotle assumes what is in question."^[37] Later Salviati uses hyperbole to claim that Simplicio prefers rhetoric to science when it comes to solving the problems of physics: "A thousand Demostheneses and a thousand Aristotles would be left in the lurch by every mediocre wit who happened to hit upon truth for himself."^[38] Salviati claims that in dealing with the Aristotelians he has to repeat his point a thousand times, once again relying on hyperbole to deliver his critique. Later in the dialogue, they are accused of having attacked Copernicus without having read his work. The Aristotelians are also accused of falling victim to their own sophistry. Since they have convinced the ignorant "silly sheep" that his theories are true, they turn around and become persuaded by the masses that they must be true because so many people believe them to be true:

SAGR: Such people remind me of that sculptor who, having transformed a huge block of marble into the image of a Hercules or a thundering Jove, I forget which, and having with consummate art made it so lifelike and fierce that it moved everyone with terror who beheld it, he himself began to be afraid, though all its vivacity and power were the work of his own hands; and his terror was such that he no longer dared affront it with his mallet and chisel.^[39]

He then accuses Simplicio of sophistry, "to that which is false become true in the defiance of nature."^[40] This charge was particularly galling to a group of scientific clerics who believed they were following in the steps of Aristotle and Aquinas. At various points, fallacies are put into Simplicio's mouth. For example, he argues that because Aristotle is an ancient, his theories should receive more respect: "His antiquity alone, and the mighty name he has acquired among so many men of distinguished mind, should be enough to earn him respect among all the learned."^[41] Throughout the dialogue he consistently commits the fallacy of authority: "SIMP. Still, I am much more impressed by the authority of so many great authors, and in particular. You shake your head, Sagredo, and smile, as if I had uttered some absurdity."^[42]

This use of authority is condemned in several ways. First, Salviati complains about the use of testimony instead of real, material evidence. Second, he complains about using historians and others, as if they were philosophers (scientists):

[W]hat is more revolting in a public dispute, when someone is dealing with demonstrable conclusions, than to hear him interrupted by a text (often written to some quite different purpose) thrown into his teeth by an opponent? If, indeed, you wish to continue in this method of studying, then put aside the name of philosophers and call yourselves historians, or memory experts; for it is not proper that those who never philosophize should usurp the honorable title of philosopher.^[43]

The Aristotelians are also accused of throwing good money after bad because they have invested so much in their theory:

I pity [Simplicio] no less than I should some fine gentleman who, having built a magnificent palace at great trouble and expense, employing hundreds and hundreds of artisans, and then beholding it threatened with ruin because of poor foundations, should attempt, in order to avoid the grief of seeing the walls destroyed, adorned as they are with so many lovely murals, or the columns fall, which sustain the superb galleries, or the gilded beams, or the doors spoiled, or the pediments and the marble cornices, brought in at so much cost - should attempt, I say, to prevent the collapse with chains, props, iron bars, buttresses and shores.^[44]

This elaborate and windy metaphor is ridicule at its finest, not unlike Edmund Burke's famous attack on Lord North's "finely tessellated" cabinet. The metaphor's hundreds of artisans call to mind the army of Aristotelian priests defending the old order. The structure itself reminds one of the pope's palaces; thus, it may have been this passage more than any other that caused Pope Urban VIII to believe he was being ridiculed in the dialogue.

Simplicio and the Aristotelians are also accused of dogmatism. He holds "inveterate affection" for "deeply rooted opinion."^[45] Simplicio says at one point: "I have not observed such things; second, that I do not believe them; and then, in the third place, if you should assure me of them, and show me proofs of them, that you would be a veritable demon."^[46] Simplicio is no friend of the scientific method of Aristotle, and is chastised for this bigotry: "And you are so credulous as to let yourself be persuaded of this nonsense, when you have your own senses to refute it and to learn the truth?"^[47] This appeal for empiricism is later followed by the accusation that the Aristotelians use scripture for their own purposes in "apish puerilities."^[48]

There are more calls for empiricism. In a lengthy analogy, Sagredo shows that Aristotelians rejected the anatomical lessons of the Galenists even when shown the physical evidence as proof of their theories.^[49] He demonstrates the "absurdity of this Peripetetic reply."^[50] Then he asks a rhetorical question to clinch the argument: "Is it possible for you to doubt, that if Aristotle should see the new discoveries in the sky he would change his opinions and correct his books and embrace the most sensible doctrines, casting away from himself those people so weak-minded as to be induced to go on abjectly maintaining everything he ever said?"^[51] This rhetorical flourish is common at the end of the arguments in the dialogue. They are marked with rhetorical questions, periodic style, and such figures as repetition and polysyndeton.

Simplicio's circle is eventually charged with doing more harm to Aristotle's reputation than good. Aristotle, it is argued, was, after all, an empiricist, who was capable of changing his mind. Salviati says, "I often wonder how it can be that these strict supporters of Aristotle's every word fail to perceive how great a hindrance to his credit and reputation they are, and how the more they desire to increase his authority, the more they actually detract from it."^[52] Sagredo attempts to explain this phenomenon by arguing that these Aristotelians are more interested in saving their own reputation than Aristotle's. He concludes with a sarcastic rhetorical question, again demonstrating Galileo's diverse argumentative arsenal: "Now what is this but to make an oracle out of a log of wood, and run to it for answers; to fear it, revere it, and adore it?"^[53] Various Aristotelian theories are then taken apart, such as the one on air resistance. Salviati concludes the argument: "How many propositions I have noted in Aristotle's science that are not only wrong, but wrong in such a way that their diametrical opposites are true!"^[54] On the other hand, Aristotle himself is praised for teaching how to undo fallacies.^[55]

The Aristotelians are also attacked with other forms of colorful vitriol: "Such men really deserve to encounter a Medusa's head which would transmute them into statues of jasper or of diamond, and thus make them more perfect than they are."^[56] The sarcasm combines with the reference to mythology to give the attack an uncanny ethos.

At the same time, the Copernican theory is advanced and defended using many of the same rhetorical devices. Sagredo claims that everyone who has been properly exposed to it has been converted. In making this case, he commits a similar fallacy to the one attributed to Simplicio. Just because everyone agrees to a theory does not make it true.

In these constructive sections, the ridicule of Simplicio continues. He is accused of "pretending" to be stupid.^[57] The condescension continues throughout. Phrases such as "Now try, if you can ..."^[58] and "I am giving you the very best that is in me"^[59] punctuate the exchanges. Salviati claims that the Aristotelians have made the "Italians" into "laughing stock for foreigners."^[60] Finally, Sagredo claims that Copernicus is too sophisticated for the prejudice and ignorant.^[61]

One wonders what would have happened to Galileo had he restrained himself rhetorically and simply written a straightforward paper on the two systems under consideration. The ridicule of the Aristotelians certainly caught their attention, but it would also lead to Galileo's trial and obscure his findings for years to come.

In 1629, Galileo submitted the *Dialogue* to the Inquisition for approval and arrived in Rome in 1630 to obtain a license to print the manuscript. Luckily, the review of the *Dialogue* was undertaken by Father Riccardi, who had approved *The Assayer*. When he approved the *Dialogue*, Galileo was delighted. However, the prince in Rome, who was to publish the work, suddenly died, and Galileo was forced to find another publisher. Before he could seek one in Florence, he had to submit the manuscript to the Inquisition there. Once the Florentine review was underway, Father Riccardi in Rome decided that more changes were needed in the preface and conclusion. The book was not published until 1632 and then with certain changes. It immediately sold out. Galileo's preface makes much of the fact that the *Dialogue* had been subject to prior restraint and had been approved by church censors in two cities. Galileo must have felt very secure at this moment of publication that he was safe from persecution. Furthermore, since the *Dialogue* was fictional and speculative, he had not violated the Edict of 1616 requiring that all writing about Copernicus be limited to the hypothetical. However, in the same preface, Galileo hinted that the Edict of 1616 was like other injunctions against scientific research that should be discarded:

Several years ago there was published in Rome a salutary edict which, in order to obviate the dangerous tendencies of our present age, imposed a seasonable silence upon the Pythagorean opinion that the earth moves. There were those who impudently asserted that this decree had its origin not in judicious inquiry, but in passion none too well informed. Complaints were to be heard that advisors who were totally unskilled at astronomical observations ought not to clip the wings of reflective intellects by means of rash

prohibitions. Upon hearing such carping insolence, my zeal could not be contained.^[62]

This argument coming so early in the work must have set censors buzzing.

GALILEO ON TRIAL

The pope took the narrow path because the war against the Protestants was going badly, he was losing the allegiance of some nations, and he felt the need stamp out dissent wherever possible. Convinced and insulted that the Simplicio character represented him, Urban banned Galileo's *Dialogue* and ordered him to Rome for a hearing before the Holy Office of the Church. Cardinal Niccolini and the pope's nephew, the new Cardinal Barberini, immediately tried to intercede on Galileo's behalf in part because the scientist was too ill to travel. An indication of the pope's anger can be seen in the fact that he refused to believe the doctors examining Galileo and demanded that he be brought to Rome. Ferdinand Medici II had succeeded to the throne of Tuscany and threw his weight behind Galileo. When the pope was unmoved, the 68-year-old Galileo was carried in the Grand Duke's litter to the Tuscan Embassy in Rome.

Galileo referred to Cardinal Bellarmine's letter of 1615 allowing "hypothetical" discussion of Copernicus' theory.^[63] This letter along with Galileo health delayed the trial into his 69th year.^[64] On April 12, 1633, Galileo met with two inquisitors and their secretary. They questioned Galileo on his understanding of the Bellarmine letter. In the next week, the *Dialogue* was examined and found to endorse Copernicus' theory in no uncertain terms. That the book was written in the vernacular, had been revised before publication, and had a change of publishers aroused the suspicion of the inquisitors. Galileo was portrayed as a duplicitous seducer of the common folk. Thus, the pope summoned ten Cardinals to serve as a jury in the trial of Galileo.

Though distressed at the turn of events, Galileo took some comfort in the fact that his former student, the pope's nephew, was on the panel. On April 30, 1633, Galileo was given a second hearing at which, as suggested by his advisors, he admitted to bad judgment. Galileo said, "I freely confess that in several places it seemed to me set forth in such a form that a reader ignorant of my real purpose might have reason to suppose that the arguments brought on the false side, and which it was my intention to confute, were so expressed as to be calculated rather to compel conviction by their cogency than to be easy of solution."^[65] Specifically, he claimed his theory of tides was presented too much as if it were fact instead of speculation. He then condemned his own "vainglorious ambition." For two weeks, Galileo had been confined at the Holy Office, after which he was permitted to return to the Tuscan Embassy.

On May 10, 1633, Galileo arrived before his questioners with a written statement that re-asserted his misunderstanding of the Bellarmine letter and the Edict of 1616. He pled for forgiveness. Pressured by Urban, Ferdinand II suddenly cut off financial support for Galileo, though the Tuscan ambassador continued to provide food and housing. Urban also encouraged a unanimous verdict from his jury of Cardinals, knowing he already had a majority. On June 16, the pope met with the jury and ordered them to question Galileo with regard to his intentions in publishing the *Dialogue*. He was examined in this regard on June 21, where he said, "I do not hold this opinion of Copernicus.... I am here to obey."^[66] The next day, Galileo was found guilty of heresy; his *Dialogue* was banned. Seven of the ten jurors signed the verdict. Galileo believed all was lost, including his honor.

After some negotiation, it was announced that Galileo would be kept under house arrest at the Tuscan Embassy and do penance for three years. Galileo disputed two of the charges: that he was a bad Catholic and that he had gotten his book published by changing venues. He then knelt and recanted his heresy: "I curse and detest said errors and heresies."^[67] It is most likely a myth that he added, "But it still moves," referring to the earth. Had he done that, he would have been burned at the stake, or at the very least, have badly embarrassed those negotiating for his release.

The activity of Urban VIII behind the scenes indicates not only how affronted he was by Galileo's writing, but how intent he was on stamping out heresy in the church. In the end, however, and perhaps because Galileo recanted, Urban showed mercy and allowed Galileo to leave Rome in the custody of the Duke of Siena.^[68]

News of Galileo's sentence had many effects. In July of 1633, Ascanio Piccolomini, the Archbishop of Siena, endorsed the *Dialogue* and took custody of Galileo at his palace. Galileo suffered a nervous breakdown and Piccolomini nursed him back to health. Despite its being banned, the *Dialogue* sold well on the black market. Rene' Descartes, however, decided not to publish *Le Monde*, in which he had endorsed Copernicus' theory.

Once recovered, Galileo took up the question of motion; he methodically refuted Aristotle. Eventually these studies resulted in his final book *Discourse and Mathematical Demonstration Concerning Two New Sciences*. He used the dialogue method again with the same three characters from the book that had gotten him in trouble. However, this new dialogue was much more civil and much less arrogant than the previous one. Galileo later said it was his most important work. It proved his most difficult to get published. Inquisitors challenged him in Venice; Jesuits fought him in Germany. Finally, he procured a contract in Holland.

Jealous clerics then sent word to Urban that Piccolomini was indulging Galileo and encouraging more heretical thinking. Urban solved this problem by allowing Galileo to move home to Arcetri under house arrest. He was also not allowed scholarly visitors nor to teach pupils. He was allowed to attend mass and to visit his daughter at her nunnery in their home town of Arcetri where she died in 1634.^[69] Those around Galileo saw that he was crushed and regularly allowed violations of the visitor sanction. Thomas Hobbes and John Milton, for example, came to Arcetri to visit the scientist. By 1638, Galileo was blind. He died in 1642.

While many praised Galileo for his teaching and his tenacity at publishing his theories, Pope Urban refused to eulogize him. Almost a hundred years later, Pope Clement XII, a Florentine, erected a tomb for Galileo in Santa Croce near Michelangelo's burial place. The great artist had died only hours before Galileo was born, and some believe the soul of the sculptor was re-incarnated in Galileo.

CONCLUSION

Over time, Galileo's trial and treatment have taken on mythic elements. While Galileo was kept under house arrest, he was never in a dungeon, nor anything resembling one. He was housed in embassies, palaces, and eventually his own

home during the periods of sentencing and probation. Though the pope's attack on Galileo destroyed the Roman Academia, his followers established the Florentine Accademia del Cimento in 1657 to carry on his work. However, Galileo's *Dialogue* was not removed from the Index until 1835. And only on Halloween of 1992, three-and-a-half centuries after his death, did Pope John Paul II admit that errors had been made by the Aristotelian advisors to the pope. Thus, while Urban VIII and some of his jurors must take blame for the shameless treatment of Galileo, it should not be shared by the Catholic Church as a whole. Three of Galileo's jury supported him, as did many other Cardinals and church officials.

In fact, there is plenty of blame to go around. The academic community deserves as much blame as the clerical for its stiff-necked defense of Aristotelianism. Then as now professors were not above insidious attacks on those that differed with them.

Finally, we need to note that Galileo's argumentation is also to blame for his plight. He began his career on the right path. He sought to combine observation with reason and mathematics to produce proofs. Reason needed empirical verification, and observation needed to be guided by reason. Together they could test theory and persuade others to embrace it. He sought a mathematical explanation of nature in general, and the universe in particular. It was not long before Newton and Descartes were building on Galileo's work to advance it into the modern era.

However, as we have seen, Galileo's writing was sarcastic, cutting, dismissive and arrogant. The characters he developed in his dialogues engaged in hurtful satire which enraged his enemies and eventually offended his friend the pope. While those who defend freedom of expression, certainly would defend Galileo's right to use these tactics. Those who teach the criticism of argumentation might point out that his strategies often made his message unpalatable. In this way, Galileo bares some responsibility for the delays in advancing his theory.

ENDNOTES

- [1]. Marcia L. Colish, *Medieval Foundations of the Western Intellectual Tradition, 400-1400* (New Haven: Yale U. Press, 1997), p. 275.
- [2]. Richard E. Rubenstein, *Aristotle's Children: How Christians, Muslims, and Jews Rediscovered Ancient Wisdom and Illuminated the Dark Ages* (New York: Harcourt, 2003), p. 147.
- [3]. There were 70 libraries in Cordoba alone.
- [4]. Fernand van Steenberghen, *Aristotle in the West: The Origins of Latin Aristotelianism*, Leonard Johnson, trans. (New York: Humanities Press, 1970), p. 67.
- [5]. Rubenstein, p. 237.
- [6]. Rubenstein, p. 253.
- [7]. Catholic officials used the Inquisition as far back as the 1100s.
- [8]. Martin Luther, "Against Scholastic Theology," in *Luther's Works*, Vol. 31: *Career of the Reformer*, Harold J. Grimm, ed (Philadelphia: Muhlenberg Press, 1957), p. 12.
- [9]. Around 1585, Galileo actually mapped Dante's hell from the *Divine Comedy* and then gave lectures on the subject. Later he repudiated this work as inaccurate.
- [10]. Peter Pesic, "Comment on 'Galileo's Discovery of Scaling Laws,' by Mark A. Peterson," *American Journal of Physics* 70 (2002): 1160-61.
- [11]. For detailed accounts of Galileo's theories, see Stillman Drake, *Galileo: Pioneer Scientist* (Toronto: U. of Toronto Press, 1994).
- [12]. See Rubenstein, p. 161.
- [13]. See Jean Dietz Moss & William A. Wallace, *Rhetoric and Dialectic in the Time of Galileo* (Baltimore: The Catholic University of America Press, 2004).
- [14]. See Drake.
- [15]. The Barberini family symbol was the bee. One can still see them above the altar of Saint Peter in St. Peter's Cathedral in the Vatican.
- [16]. Ptolemy used mathematics to deduce a geocentric theory of the universe. He invented epicyclic theories of motion that allows him to differentiate planets from stars. Copernicus (1473-1543) corrected Ptolemy by developing a heliocentric theory. *De Revolutionibus Orbium Coelestium* was published the year of his death, and somewhat suppressed by those prejudiced in favor of Aristotelian science.
- [17]. Drake, p. 171.
- [18]. Dava Sobel, *Galileo's Daughter* (New York: Walker and Company, 1999), p. 67.
- [19]. Thomas Conley, "Vituperation in Early Seventeenth Century Historical Studies," *Rhetorica*, 22 (2004): 169-182. It is interesting to note that Jesuits were often involved in this type of rhetoric. See pp. 170, 173, 175. Since many of these diatribes concerned science, it is safe to assume that Galileo was familiar with them. See p. 177. Conley writes, "The virulence of this scholarly vituperation is not hard to explain if we bear in mind that what sometimes appears to be mere quibbling about manuscript readings or astronomical lore must be read against the background of fierce contestations over such matters as calendar reform, papal succession, the reliability of early Church historians ..." (P. 178.)
- [20]. Sobel, p. 102.

- [21]. Urban's foreign policy was a disaster. At one point, he allied the papacy with France even while it was using Protestant armies against the Catholic Habsburg rulers of the Germanic provinces.
- [22]. Sobel, p. 138.
- [23]. When Galileo heard the report of this misrepresentation, he felt like Boethius who was falsely accused of betraying his emperor, Theodoric.
- [24]. Galileo Galilei, *Dialogue Concerning the Two Chief Systems*, Stillman Drake, Trans. (Berkeley: University of California Press, 1967), p. 5.
- [25]. Of course, Aristotle's school was called the Lyceum. However, because its faculty tended to pace while teaching, it got dubbed the Peripatetic school.
- [26]. Galileo, *Dialogue*, p. 6.
- [27]. Galileo, *Dialogue*, p. 35. In the next few lines, the spirit of Plato is extended: "SALV. Simplicio, we are engaging in friendly discussion among ourselves in order to investigate certain truths. I shall never take it ill that you expose my errors; when I have not followed the thought of Aristotle, rebuke me freely, and I shall take it in good part. Only let me expound my doubts and reply somewhat to your last remarks."
- [28]. Galileo, *Dialogue*, p. 30.
- [29]. Galileo, *Dialogue*, p. 223.
- [30]. See, for example, *Dialogue*, p. 30.
- [31]. Galileo, *Dialogue*, p. 56.
- [32]. Galileo, *Dialogue*, p. 69.
- [33]. Galileo, *Dialogue*, p. 30. Later on p. 59, he refers to Simplicio's "stupidity."
- [34]. Galileo, *Dialogue*, p. 108.
- [35]. Galileo, *Dialogue*, p. 185.
- [36]. Galileo, *Dialogue*, p. 220.
- [37]. Galileo, *Dialogue*, p. 35.
- [38]. Galileo, *Dialogue*, p. 53-54.
- [39]. Galileo, *Dialogue*, p. 112. The masses are regularly referred to as the "herd," "sheep," "ignorant," and so forth.
- [40]. Galileo, *Dialogue*, p. 54.
- [41]. Galileo, *Dialogue*, p. 110.
- [42]. Galileo, *Dialogue*, p. 107-8.
- [43]. Galileo, *Dialogue*, p. 113.
- [44]. Galileo, *Dialogue*, p. 56.
- [45]. Galileo, *Dialogue*, p. 97.
- [46]. Galileo, *Dialogue*, p. 157. The dogmatism in these remarks may have echoed that of Urban VIII.
- [47]. Galileo, *Dialogue*, p. 151.
- [48]. Galileo, *Dialogue*, p. 357.
- [49]. Since the episode reportedly takes place in Venice, it is very likely that Galileo actually witnessed the event. The rejection of William Gilbert's theory of magnetism is used later in the *Dialogue* to document the dogmatism of the Aristotelians.
- [50]. Galileo, *Dialogue*, p. 108.
- [51]. Galileo, *Dialogue*, p. 111.
- [52]. Galileo, *Dialogue*, p. 111-12.
- [53]. Galileo, *Dialogue*, p. 113.
- [54]. Galileo, *Dialogue*, p. 153.
- [55]. Galileo, *Dialogue*, p. 131.
- [56]. Galileo, *Dialogue*, p. 59.
- [57]. Galileo, *Dialogue*, p. 220.
- [58]. Galileo, *Dialogue*, p. 223.
- [59]. Galileo, *Dialogue*, p. 258.
- [60]. Galileo, *Dialogue*, p. 280.
- [61]. Galileo, *Dialogue*, p. 329.

[62]. Galileo, *Dialogue*, p. 5.

[63]. Sobel, p. 247.

[64]. In the trial transcript, he is mistakenly identified as being 70 years of age.

[65]. Sobel, p. 257-58.

[66]. Sobel, p. 272.

[67]. Sobel, p. 276.

[68]. It should be noted that the Doctrine of Papal Infallibility was propounded in 1870 by Vatican I. It applies only to matters of theology.

[69]. Virginia, who took the name Maria Celeste when she took her holy orders, was one of two illegitimate daughters that Galileo put into nunneries. We have her letters to her father, but not his responses. Galileo also had an illegitimate son.
