

Having finished our analysis of Kuhn's theory in Section 5, we are now ready to continue here in Section 6 the historical story as we have been following all along; but, here we are going to change our own conceptual and theoretical focus. Now, it is time to consider the history of science from a stand-point that takes more account of broader social forces-- institutional factors and social contexts, because science really takes place in these larger historical and social settings. We have learned all about facts, observations, instruments and criteria. These all raise 'social' and 'political' issues on a narrow basis among small professional groups and sub-cultures of Natural Philosophers. But, all that negotiating and micro-politics takes place always in larger institutional and social contexts. The next few topics invite us to look at larger institutional settings.

The first topic is the classic and much misunderstood issue of Galileo's unfortunate encounter with the Catholic Church. In October 1632, Galileo was summoned to Rome from his home in Florence, to appear before the Inquisition of the Roman Catholic Church. He was 69 years old and sick; plus he was about to go blind. Galileo was the most famous astronomer in Europe. In 1609 he had turned a telescope on the heavens and, as we know, convinced himself (and a lot of other people) that he had undermined the medieval Aristotelian world view and proven the Copernican one. In that same year of 1632 he had published a large, brilliant and entertaining book called *Dialogues Concerning the Two Chief World Systems*. In it he had argued for the truth of the new (90 year old) truth of the Copernican theory.

Galileo was summoned to Rome because what he taught in the book was a violation of Catholic doctrine. Sixteen years before, in 1616, the Catholic Church had decreed that to teach Copernican theory as the truth was heresy. Galileo was now a suspect of heresy; he was tried, found guilty (and given the terms of reference he probably was guilty, but more of this later) and he was made to abjure, to deny his beliefs and to correct himself.

On the 22nd June 1633 he came before the judges and kneeling he recanted his Copernican beliefs:

I, Galileo, son of the late Vincenzo Galileo Florentine aged 70 years arraigned personally before this tribunal and kneeling personally before you Most Eminent Cardinals Inquisitor General against heretical depravity throughout the Christian commonwealth, having before my eyes and touching with my hands the Holy Gospels, swear that I have always believed, do believe and with God's help will in the future believe all that is held, preached and taught by Holy Catholic and Apostolic Church, whereas, after an injunction had been lawfully 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 immobile 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 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 treated this new doctrine, already condemned, and brought forth arguments in its favour. I have been judged to be vehemently suspected to heresy, that is of having held that the Sun is the centre of the world and

immobile and that the Earth is not the centre of the world and moves.

Therefore desiring to remove from the minds of your Eminences and of all faithful Christians this vehement suspicion rightly conceived against me with sincere heart and unpretended faith, I abjure curse and detest the aforesaid errors and heresies and also every other error and sect whatever 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 cause a similar suspicion toward me. Further should I know any heretic or person suspected of heresy I will denounce him to this Holy Office or the Inquisitor of the place where I may be.

Now the situation, as most people will understand it is this: We have Galileo who is right, in that he used the scientific method and the telescope the right way and found the truth. Then we have the Church (it could have been the State but it's just another big institution) which does not care about the truth, and is just defending its own self-interested, biased, superstitious beliefs. Indeed, ever since then, most people looking at this event have further concluded that Science must be opposed to Religion (there must be some essential contradiction between the two), because religion is based on myth, falsehood and superstition, whereas Science is based on objective knowledge. People have further concluded that in general for this not to happen again, Scientists must be allowed freedom and independence and autonomy from any other social institution ie: the State, Church, anything really that is not run by and for Scientists, who are the only ones who really know what the game is about.

We are going to be looking at the Galileo case more closely, because it is not as black and white as it appears. I think we can learn a lot about what was really going on and also what is misleading about the common beliefs that people have taken away from the Galileo affair as usually understood. Firstly, we are going to talk generally (in a 17th century way) about the Bible and about Truth and Heresy. What was going on, what were the real issues? We will try to build a picture that is not so cut and dried, black and white as that standard version.

Science, The Church & Biblical Interpretation in the 17th Century:

I said that the Catholic Church condemned Copernicanism in 1616, which was 73 years after Copernicus died. It was only then that the Catholic Church took an official stance against Copernicus. The 1616 decision was handed down by the Congregation of the Holy Office which was a kind of ruling Cabinet and Supreme Court for the Church. They said that the idea that the Sun is stationary in the centre of the heavens and that the Earth moves is “false in philosophy”-- meaning it is false in science or rather more exactly, Natural Philosophy. This decree is not so important, but this was the way of making a foundation, a basis, for the next thing that they wanted to say. For not only is it ‘false in philosophy’, but in religion it is *heretical* to believe the Sun is the centre of the heavens and the Earth moves around it. We cannot get into trouble for something that is false in science, but what the Church is really concerned about is heresy, and clearly they have just defined the new heresy: believing in Copernicus’ theory as true.

What did Heretical mean? It has a technical, legal, administrative meaning; it is not a loose term. By definition, a belief is heretical if it violates an important Church doctrine, that is, a doctrine crucial to people’s faith and morals ie: central to any view that, as a Christian, you need in order to be saved. But in addition, the doctrine that you

are violating or denying must be taught in the Bible and it has to be agreed upon by all Church experts throughout history. (By 'expert' they do not include Luther or Calvin who themselves are heretics, but good 'experts' like Aquinas, Augustine, the present Pope, Paul V, and his various theologians, cardinals, etc. 'Expertise' is a social construct after all.)

The Church was saying, officially, that in the Bible it is stated truly that the Sun moves and the Earth stands still, and that a person's salvation depends on their believing in this. They were concerned about some biblical passages in particular. I cite them from the King James Anglican version rather than from the Latin they would have read in the Vulgate.

“The Sun also riseth and the Sun goeth down and hasteth to his place where he arose”.
Ecclesiastes I.5.

This appears clearly to be stating that the Sun rises and sets (and that the Sun is male). That is what it says, so maybe we should not read everything literally, you just read the parts that you are told to read literally. For instance, the Sun is not mal--that is just a manner of speech, but it is not a manner of speech that the Sun 'ariseth' and 'sets' -- that is a fact!

“Thence spake Josua to the Lord in the day when the Lord delivered up the Amorites before the children of Israel. And he said in the sight of Israel, Sun stand thou still upon Gibeon and thou Moon in the Valley of Ajalon. And the Sun stood still and the Moon stayed until the people had avenged themselves on their enemies.”
Book of Joshua X. 12-13.

Some very tricky theology comes in here. This is Joshua's miraculous victory over the enemies of the Hebrews with help from God. Now, let's play theologian. Obviously that is a report of a miracle that happened. The Sun miraculously stopped to lengthen the day so that the Israelites had more time to smite the Amorites. Now, if it is a miracle that the Sun stands still, then it is 'the ordinary course of nature' that the Sun moves, ariseth and seteth--theology is very logical. There are many other passages that can be construed with such impeccable logic, backed by a massive Aristotelian cultural grid that was drilled into future theologians from 13 years of age.

What did this ruling of 1616 mean? Here it is possible to be led astray. Firstly, it meant that a Catholic could not publicly teach that Copernicanism is true. If you did so, you were committing heresy. But, you could teach it as a hypothesis, a useful, predictive fiction. This, of course, is what had happened with many of the technical details of Ptolemy's theories, they had long been accepted as merely fictional, because they were too complicated: epicycle upon epicycle, equant plus eccentrics -- the details are fictional but that had been the position since Antiquity. But, there was something else. If you were a Catholic and in good conscience you genuinely believed that Copernicanism was true, you might still believe it, but you could not relate your beliefs to anyone else, because that would be heresy. The reason for this is that the Pope refrained giving this decree the highest level of approval. Popes can give their decrees various degrees of strength of approval. The highest level is called *Ex Cathedra* (from the Chair). If he had done that, you could not even believe Copernicanism was true in your conscience. Now do not be taken in by 19th century liberal Protestant propaganda and 19th century anti-religious propaganda which states that the Pope in 1616 claimed

to be 'infallible' and said no-one could believe in Copernicanism at all. There are subtle nuances here: you could believe in Copernicanism as a hypothesis, or believe in it as true if you believed in good conscience and in private.

There were levels of legal and bureaucratic sophistication in the workings of Catholic Church at the time that were more sophisticated than the Bible bashing that you might have received from a typical Puritan or radical Protestant of that age. I will have more to say about this distinction between Catholics and Protestants below. Anyway at his trial in 1633, Galileo claimed that he had only taught Copernicanism as an hypothesis, so he claimed he was in the clear. But you cannot read his book and think that he taught it as a hypothesis, you have got to think that he is teaching it as true. It is true that after reading 550 pages of pro-Copernicanism you come to one paragraph where one of the characters says: "But, after all God could have made the cosmos any way he pleased and we do not really know for certain, do we?" This disclaimer was supposed to justify Galileo's claim that he was teaching Copernicanism only as a hypothesis. But, none of the theologians were very impressed by the let-off. The book, the *Dialogues*, was about showing that Copernicanism was true.

The issues here in the 17th century were not the issues that 19th and 20th century writers have pushed into this picture. The issue was not Science versus Religion, or Galileo trying to undermine the Church. The issue was more Galileo, the good Catholic, trying to make sure that the Church taught as official truth what he had come to believe was the truth. He did not want the Church to teach something that he really was convinced was false; that is, Ptolemy.

We can understand the state of mind of Galileo and his friends and of Galileo's opponents and the Church if we run through the following argument. First of all, there were many things that Galileo and his opponents agreed upon. They agreed that the Bible contained truths. There is no doubt about that for Christians: Copernicus believed that, Galileo believed, the Pope etc. all believed. These were not 19th century Rationalists or Atheists. Secondly, most of them believed that Natural Philosophy (or Science) can also discover real truths. So they believed in scientific truth and biblical truths. The issue is what happens along the borderline. What happens if truths in the Bible conflict with truths in Science? This is the basic thing that they are arguing about. It is not anti-science or anti-religion, but a question of getting the relationship right between biblical truth and scientific truth. Both sides want to get the relationship right but they have different opinions. They are not like us. They would not argue it as we would, because they are of a different mentality.

So far we have seen what they agreed on, but where you start to get distinctions is at the next level of questions. Different Christians of differing viewpoint, who are honest and forthright can differ over the following issues: What truths or what kind of truths does the Bible contain? Some Christians will maintain (then and now) that the Bible only teaches truths about faith and morals; that is, the basic belief and moral fundamentals of the day, in other words, what you need to know to be saved. Everybody who is a believing Christian would assent to that, but now does that mean that the Bible also contains true historical facts. Are Adam and Eve true? You will find lots of liberal Christians who believe this is only a beautiful allegory. Does the Bible teach any history as fact and how much is true?

Beyond that level we come to an area where there could be and there indeed was legitimate widespread disagreement. In the 17th century, (in fact even as far back as the beginnings of Christianity), there had been legitimate disagreement over the next point:

How much truth about nature does the Bible teach? You can find fathers of the Catholic Church, ancient theologians, who have said “the Bible is not meant to teach Natural Philosophy”. It is not a textbook of Natural Philosophy; it is meant metaphorically, allegorically when it talks about nature. On the other hand, there were a lot of people who were inclined to believe that the facts about nature that come to us via the Bible are the true facts *because* they are in the Bible. Obviously, this is where they are going to have problems. But it isn’t as though every Christian believes the Bible teaches Science and Galileo says “no”. It is a lot grayer than that. Galileo is even willing to admit that there are some small messages about science in the Bible, but you have to know how to interpret them. Galileo even used the Joshua passage and (after some very fancy interpretation) claimed it was evidence for the truth of Copernicanism.

The next issue is that, if there is truth in the Bible how do you get it out? The truth in a book or a text does not just fall out of the book, just like facts don’t fall off trees, they have to be ‘read’. In those days there were two opinions at each end of a spectrum. One way to get the truth out of the Bible is a theory of literal reading by individuals. Anyone who is a moral, upright person is entitled to read the Bible and get the truth out of it. The concept is that there is something like ‘literal’ meaning: a text has a meaning and you can either get it right or wrong. This is a fundamentally Protestant way of reading, although they did not always do this. (By the way, modern theories of textual criticism do not accept this because there is no literal given reading of a text, the meaning has to be made up by the reader dependent upon where he/she is coming from. Some would say there are as many texts as there are readers.)

The alternative belief on textual analysis (and this is more the Catholic style which is more sophisticated than the literal reading) is that the truth is there but the reader has to be guided by expert opinion on how to read it. In other words, you have to have expert guidance on how to get the truth out of the Bible. And, we all know who the experts are -- they are the biblical interpreters, theologians and the Pope, who lay down the rules. Sometimes they say to read a particular text more or less the way it appears on the page, for example the ones about Joshua. If it says the Sun moves, take it that the Sun moves. But of other texts they might say 'read this bit metaphorically'. For example, in that text from Ecclesiastics, obviously they are not going to claim that the Sun is male for it is a physical object being neither male or female. We read that metaphorically, but the part about the Sun moving, that can be read literally in this case. You need a guide to explain how to read the Bible. These are the two ends of the spectrum: the Protestants are driven to a literal reading and the Catholics are driven, having a basically correct theory of texts, to an authoritarian imposition of meaning.

Now we can finally see what has happened in the 1616 decree. In that decree the Catholic Church said the Bible teaches astronomy and read the passages literally, not as poetry or allegory. The counter-argument is not an anti-religious argument, but a different viewpoint on biblical interpretation. Perfectly legitimate Christians have the viewpoint that the Bible is not a science book: It was not written by inspired writers in olden days to teach people modern physics: that was not God’s intention. Another fallback position is that you could say: there might be some science in there but you have to work hard to get it out for these literal meaning are not the real meaning; for example, maybe they mean the exact opposite in certain instances. Those are the issues. Galileo takes one position and the Church, unfortunately for him, takes the other position. This is not good guys versus bad guys; pro-science and anti-religion. This is “where is the truth?”, “How do you get it out of the text?” etc. Those are the basic terms of the problems.

Galileo's Early Career:

Now we have to look at Galileo's career, following it through from near the beginning down to his trial and condemnation. Galileo was born in Pisa in 1564. He came from a family of somewhat ambiguous social status. His father was an important Court musician, which does not quite make you a gentleman. Being a musician is not a real profession like medicine or law. So in a quite understandable move to solidify social status, Galileo was intended for medicine. He went to the University of Pisa; did not like medicine but he did like mathematics: not the wild neo-Platonic harmony-mongering mathematics that Kepler practiced, but good practical mathematics, the kind that engineers or architects use in fortification theory, measurement, cartography, and problem-solving. Galileo devoted himself to that and gained a position teaching mathematics at Pisa, where he worked on something which we shall hear more about later, his new mathematical science of moving bodies what we call 'classical physics' or 'classical mechanics' which he apparently started working on as a point of attack against Aristotelianism. He wanted to replace Aristotle's verbal, qualitative theory of bodies and motion with a mathematical one. He gained a better position in 1591 at the great University of Padua which is near Venice and was under the control of the Venetian City State, part of the the Mediterranean empire that Venice was running at that stage.

An important point is that Galileo taught at Padua for 18 or 19 years. Padua was a University, almost unique for having no theological faculty. There were no professional theologians at Padua, just philosophers, logicians, medical men and lawyers. Padua was a hot-bed of exploratory radical Aristotelian thinking. To a certain extent, Galileo was tarred with the brush of having been associated with this place. Another point is that Padua under Venetian control and Galileo spent a lot of time in Venice and had a lot of Venetian friends. The thing about Venice that you must understand is that it was a major political State and it was largely opposed to the political power of the Popes. The rulers in Venice, the elite, the merchant princes, were renowned for not being particularly orthodox Catholics--certainly not the Spanish type Catholics who were fiercely protective of the Faith--because their political power rested and depended to some extent upon confronting the political pretensions of the Papacy. Venice was not a hot-bed of Inquisition and persecution. It had more of a liberal Catholic, free-thinking atmosphere. Now that too is something that goes against Galileo's case later in his career, because he carries this tag of a Venetian, liberal thinker. On the other hand, Venice and places like it, gave him part of his accepting audience for his telescopic reports. These were the kind of people, educated, liberal, lay Catholics, who believed Galileo's book, *Sidereal Messenger*.

In 1609 and 1610 we have the telescopic work and the attempt by Galileo to convince himself and his audience that he now had the evidence that Aristotle was wrong and that Copernicus was right. That is the situation we left at the end of Chapter 14. In the next stage we will look at what Galileo did after 1609. At first his campaign looked likely to be successful but then it progressively contributed to bringing Copernicanism into dispute with the Church by 1616. We shall see that this outcome was not, as is commonly believed, a case of science versus religion, once we view it in its actual intellectual and social context.

Toward the Condemnation of Copernicanism 1609-1616:

We are now looking towards 1616 which is the year that the Catholic Church decreed that to speak publicly of Copernicanism as though it were true was heresy. The first thing we need to consider during these years is the impact of Galileo's telescopic

observations and publications. When you do history, especially history of science, you have to be very careful in judging the different segments of an audience for a particular idea or work. There is no such thing as an audience in general. Advertising executives know this, as do politicians, and historians have to know this as well. So, we are going to segment the reading audience for Galileo's initial Copernican telescopic observations and talk about the responses of the different segments the audience. It is very important not to deal with block, monolithic, sociological or historical ideas on an issue like this, because we just get mythical explanations if we do.

The first group that we need to know about, that were reading Galileo, were what I would call educated, liberal Catholics. These are people, for example, the educated, capitalist aristocrats in Venice or educated noblemen, lawyers, administrators in Catholic France. Or, for example, the students at the various Jesuit Colleges throughout Europe, who just as these things were being published were made aware (even students in their young teens) of the great discoveries of the great Catholic astronomer Galileo. For example, one such student was a very young man by the name of Rene Descartes, (who with some of his friends founded the Mechanical Philosophy). Educated liberal Catholic opinion (and I should add this is lay opinion, not the opinion of bishops, Cardinals, Popes) was that it is wonderful to see a Catholic astronomer making progress in knowledge.

The Catholics had generally been 'beaten' up by the Protestants for almost a 100 years for being stodgy and backward-looking, mired in the Middle-Ages. Obviously if you have a new theology like Calvin's or Luther's, you want to state that the old theology is reactionary, backward-looking. Here amongst more liberal thinking Catholics you have the idea that Galileo is a very great man. Now, this does not automatically mean that you are turned into a Copernican. Some lay readers are turned into Copernicans, for they are convinced by Galileo's telescopic discoveries. Some are not convinced, but think it is a very interesting hypothesis and the issue is open. So you have a spectrum of opinion there. Liberal Catholics were not likely to say "Galileo is insane!" But more likely to say: "Galileo's theory is interesting, and perhaps we should be Copernicans." Those are the two ends of the spectrum.

This was a very important issue for the younger men who read Galileo's work. Especially those like Descartes who were exposed to it in their formative intellectual years at school for they are going to be the makers and breakers of Natural Philosophy and cosmology ten, fifteen or twenty years later. So, in a sense Galileo hit a very important future audience with his work. People, like Descartes, apparently were very much convinced by Galileo's writings and they emerge in the 1620s assuming that Copernicus is right when they start to build a Natural Philosophy purely on that assumption. The most striking triumph occurs with the most impressionable people (those just completing their education in a kind of Catholic environment where 'progressive' is the important thing). So this is one of Galileo's strengths in the long-run but one of his weaknesses in the short-term, because other people do not like the fact that liberal Catholics appreciate these discoveries.

The second large group--no-where near as big demographically, but important in terms of power and influence, was the scientific opinion makers in the Church, which was represented mainly by the Jesuits, especially the more competent mathematicians and astronomers. The Jesuits were a Counter-Reformation order founded in the 16th century to hold back the Protestants, and they were doing an excellent job up to this point. They were, and still are, impeccably trained intellectuals and propagandists for the Church (there is no slur attached to the term propagandist, for every institution has

them). The Jesuits made it their business to be open-minded and informed about intellectual, theological, and scientific developments. The idea behind this was that the Church would not be embarrassed by being behind the times in those areas, so that the Church could answer and judge and sift the best out of everything that happens. (If you ever meet a practising Jesuit intellectual you are bound to be very impressed their flexibility and knowledge. In fact, other Catholics have always criticised them for their flexibility and adaptability to changing Church views to accommodate new developments.)

The Jesuits' view of Galileo's work was that it was extremely interesting and bore much closer scrutiny. Of course, what Galileo had found was consistent with the Tycho system. In fact many of the leading Jesuit astronomers were already leaning towards the Tycho system. The Jesuits' idea of the situation was that there was an intellectual problem, with questions a little up in the air as between Copernicanism and Tycho and the matter would have to be decided in the long term. It does not mean that they want to see this issue decided by hot propaganda in the short term.

Now what about the higher officials in the Church? The Church was a huge bureaucratic machine, the largest in Europe for over 800 years. We can compress these higher Church politicians and administrators into the figure of Cardinal Robert Bellarmine, who was a friend of Galileo (Galileo had many friends in the top echelons of the Catholic Church. This affected both his opportunity and his downfall in the long term).

Bellarmino was an expert theologian and politician who had spent a lifetime resolving disputes inside the Church. He resolved disputes between Dominicans and Jesuits, and Benedictines and Franciscans, to make sure that the huge bureaucracy (the Church) was in reasonably efficient, united working order so that it could operate against the Protestants. This is the way the Catholic Church worked from the top. Bellarmine was an expert at resolving disputes between nit-picking theological positions between the Dominicans and the Franciscans over exactly what free will meant, what happened at the resurrection etc., because people were willing to create great divisions in the Church over issues like this (as had the Protestants).

So, Bellarmine was the Pope's chief adviser on resolving of theological disputes. He was also an expert theologian, so he warned Galileo to be careful, not to move too fast on trying to get his theory across, and to make sure he could prove his hypothesis, but if Galileo could prove it, Bellarmine said the Church would have to change how it interprets the Scriptures. The Church moves, learns and changes its expert opinion. Now, there is doubt as to whether he really thought Galileo's theory could be proved. He may have just been fobbing Galileo off. But, he expected 'proof' of Galileo's theory before the Church would change its views.

If we look at the Pope I think we can make him one element in the audience all by himself. Pope Paul V pushes a kind of administrative consensus to the extreme, for after all he was the man in charge. He was not a particular friend of Galileo for he did not associate with intellectuals and mathematicians as much Bellarmine and some other Cardinals did. Pope Paul V was a very typical Counter-Reformation Pope. He was elected because he was a strong leader who could keep the Catholic Church in line administratively. The Pope was not elected for theology but for management skills. He was a strict authoritarian, wanting strict unity and discipline in order to combat the heretical Protestants. He was not very interested in the intellectual side of the debate

between Galileo and the Aristotelians. He did not want Catholics arguing with each other. This was a fairly reasonable counter-reformation position.

Finally I think we can include an odd alliance of Aristotelian university professors and some Catholic clerics especially some Dominicans. Here we find a very unfavourable audience for Galileo's work. Do not think that Aristotelian professors and Dominicans joined forces, for they did not, but during the 1610s we find little outcroppings of evidence that there seems to be similarity of response to Galileo's work and some management of a conservative response by these people against Galileo.

What was it that they did not like about Galileo's work? It was a gelling of common interest, for the Aristotelian professors of the more reactionary kind obviously saw their interests threatened by Galileo's appeal to the public in favour of Copernicanism. If you have invested your whole life and your career in teaching Aristotelianism in the universities you are not necessarily going to be pleased at someone coming along and claiming to have looked through some funny instrument and to have 'proved' that what you have been doing all your life is incorrect. Now, I am not saying that all Aristotelian professors acted this way, I am say that 'some' did. It is a possible response by the Scholastic professors. Certain Dominicans (not the whole order) seemed to have taken a dislike to Galileo and to have focused upon Galileo as an example of the liberal tendencies in Catholicism that is seen in Venice and in other parts of Europe where discipline is not kept at the maximum. None of this agitation by the Dominicans caused any real problems for Galileo, because some of the Dominicans were censured by their own superiors who were friends or acquaintances of Galileo. There are all kinds of sociological variables in here. It is one thing for a priest in the local pulpit to attack Galileo, but it is another thing for the Superior of the Dominican Order to attack Galileo. The former did, the latter did not.

The period of 1612 to 1616 was one of rising expectations for Galileo. He was extremely active in print and in person in Italy in the highest circles. He wanted to educate public opinion through his writings, and to lobby within the Church at the highest levels to get the leadership to agree that he was right and the Church should embrace Copernicanism. Now, as I have already indicated, some hesitation and forms of opposition also began to develop. There was some agitation by a few Dominicans against Galileo, and there was, over this period, some cooling of his relationship with the Jesuits. This 'cooling' may not have had so much to do with Galileo, but rather with a general policy shift, connected with the impending large religious war that was about to break out sooner or later in Germany and the Low Countries -- the 30 Year's War which commenced in 1618. The Jesuits had been ordered to close their ranks, so to speak, and so they were less open to Galileo. But, Galileo also contributed to the situation by producing a backlash to his work by his constant lobbying. Galileo was extremely opinionated and a very clever debater, a characteristic which can sometimes lead to insulting people or treating them badly. He often overstepped the diplomatic and political bounds in his argument which lead to the backlash, which helped lead to the decree of 1616.

One of the best pieces of evidence of Galileo making mistakes in this period is involved in the writing and the nature of his famous *Letter to the Grand Duchess Christina* of Tuscany. It was not published in his time, but it was circulated in important circles. (Galileo actually worked for the Grand Duke of Tuscany.) Galileo wrote this letter to the Grand Duchess when he was informed by one of his cronies that at the Grand Ducal dinner table, some anti-Copernican and anti-Galilean remarks and arguments had been passed to the effect that Copernicanism was heretical. In other

words, his position was being undermined by his employers and their friends. The issue was a theological one concerning Copernicanism. So he launched into a letter to the Grand Duchess to inform her of their misconceptions. This *Letter* is very easy to misread in a Whiggish sense. For instance, when I went to University we were taught the letter to the Grand Duchess as some great triumphal statement of how science should be independent of religion and how science is superior to religion.

What is actually in the *Letter to the Grand Duchess* and what does it actually do? (Remember that I am arguing that Galileo receives negative feedback from his writing this letter). The first thing he writes in his letter are a few points that are quite acceptable from a theological standpoint. The Bible was written for the common person; it is not a scientific textbook. This was a perfectly legitimate position to take. The next thing he says, which is perfectly correct, is that the Church can only rule as heretical matters pertaining to faith and morals and not matters of science. This was Church doctrine so again legally he was correct. Galileo goes on to say that two truths cannot contradict one another, there is truth in the Bible and there is truth to be gained from Science. We have heard this before, because this was a standard viewpoint of the time. Galileo then moves to the attack by saying that if Science can prove something to be true “by observation and demonstration”, the Scriptures should be reinterpreted to be consistent with that of scientific truth. That is similar to what Bellarmine was to say to him a year or two later. But now let us evaluate this against the Whiggish interpretation of the sort that I was given when I was a student.

First of all, this is not a letter against religion or the Catholic Church. It is an attempt to save the Church from making an error in his view. Galileo does not want to undermine the Church or to establish Science as something superior or antithetical to religion. He wants religion to embrace what he thinks is scientific truth. He admits the Bible does contain certain truths: it just does not contain astronomical truths. The next point is that whilst his view was legally correct, it was politically naive for the following reasons. Galileo was pretending that he was a theologian quoting theological authorities in a theological debate. Now, professional theologians do not like amateurs (or Astronomy Professors) pretending to be theologians, telling them their doctrines, for there are millions of ‘amateurs’ in Europe called Protestants. What layman would come along and pretend he is a theologian, except obviously someone who is a crypto-Protestant. While Galileo is citing all this theology, he uses many arguments from St. Augustine’s doctrines. It is acceptable to quote him, but Augustine was the only authority that Galileo cites, and, if you know anything about the Protestant Reformation, you would realise that the most favoured Catholic theologian of the Protestant Reformers was St. Augustine, for he had said a number of things that they were able to use in their arguments. So, Galileo was not an expert he was using Augustine as his only reference and so his argument looks a little tendentious, amateurish and biased from a professional theologian’s standpoint.

It is possible to argue that the Bible is not a science book, but in the political world of the 1600s obviously every interested party has a boundary between science and religion at a different point. Everybody is going to believe that the way you think about cosmology has implications for how you think about morals and the way we live; but, the question is where they draw the line at the boundary. So you may be legally correct in your assumptions, but heavily criticised or attacked because people see their world challenged or their moral order or their values challenged. You may be legally correct, but you may not be on very firm political ground. These are political and human realities that Galileo did not take into account.

It is the same thing, say, with contemporary issues about science and society. Everyone tends to say that science should be autonomous. At the same time everyone draws their own personal line where they would like to say certain research is immoral and should not be allowed to be done. So, there is an official position of scientific autonomy in the modern world, but then in practice everyone has their own moral viewpoint, their own set of values, where in fact, if they were in power, they would say to scientists you can do this kind of research but not that kind for these ethical, value, or political reasons. This is what happened to Galileo. Is it right to upset the accepted cosmology? Is it right to appear almost Protestant in the effort to get your views accepted?

Finally, there is in Galileo's *Letter to the Grand Duchess*, a statement about the proof of his theory, although he is ambiguous. But it seems as though he is saying two things, both of which are offensive. One is, that he seems to be saying he has proved, or could prove, Copernicus' theory. He also throws down the gauntlet, stating that theologians have to prove him wrong, if they want to dispute his theories. This is a very ill-judged statement from Galileo, because the theologians did not think they had to prove anything to non-theologians.

So, Galileo had friends, admirers, enemies and he was agitating and lobbying his viewpoint. Because of all of this, the Catholic Church rushed to a definitive decision about Copernicanism in light of all this agitation, counter-agitation and lobbying. What seems to have happened is that Bellarmine and the Pope became a little nervous, not so much about Galileo being a dangerous person, but they reached a point where they decided too much agitation was occurring with Catholics throughout Italy and with Galileo agitating in the higher echelons of the Church in Rome, so they therefore decided to get the experts together and decide on the issue once and for all, whether Copernicanism was acceptable or not.

In other words, it became for Bellarmine and for Pope Paul V, an administrative and political imperative to resolve the issue. The political temperature had been raised so much by Galileo, and his enemies, that it looked as though too much disturbance was being created in the Church so by making a decision, the Church could force people to follow Church doctrine. Bellarmine and the Pope called together the experts and they decide that the Copernican view is false in philosophy and heretical in theology. Had Galileo not lobbied, or written the *Letter to the Grand Duchess*, or helped to contribute to the backlash, perhaps the 1616 administrative action may not have happened right at that time. The attitude of the Jesuits would normally have been to keep things private, behind closed doors, for experts: They were open to discussion, open to evidence but it was going to take a long time. They were not being hypocritical; that was the way the Church operated. But, Galileo did not want to wait a long time. He wanted to be the man who got the Church officially to endorse Copernicanism.

One or two points about the condemnation of 1616; it was probably wrong for the theologians to have decided that cosmology was a matter of faith and morals. (As Catholic apologists of the 20th century also admit, including the Pope, who has now had a Commission to say that Galileo was right after all). But, politically, intellectually and culturally they probably did believe that cosmology was a matter of faith and morals. Legalities, political imperatives, cultural values are all mixed up in the minds of these men. As for Galileo, he was not formally censured for anything in 1616--the decree deals with Copernicanism and books about Copernicanism. So Galileo decided to remain quiet for a time. He published anonymously or had his students' name attached to some things he wrote. Then he thought his luck had changed because in 1623 his old friend Cardinal Maffeo Barberini was elected Pop, Urban VIII. Galileo thought this

gave him licence to write a treatise putting all the arguments for Copernicanism. They had some discussions and Galileo felt he had gotten the Pope's approval for the project. In nine years he produced *The Dialogue Concerning the Two Systems*, and it is to this work, and the trial and condemnation of Galileo in 1633 that we must turn in the next chapter.