

GALILEO, ASTRONOMER AND COURTIER

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Abstract. The aim of this article is not to discuss the contribution of Galileo to the modern science, of which he is regarded as one of the founders. We focus instead on the relationship between his astronomical discoveries and their cosmological consequences to the well-established patronage system of his time. We show that this system, from one side, propelled him to the position of the Europe most glorious astronomer, and from the other side led to his "fall" and the tragic end.

1. INTRODUCTION

New flourishing of the science in the West, suppressed during the long centuries of the Middle Age, comes only with the Humanism and Renaissance, in the period of the Second Scientific Revolution and Enlightenment. This is the time of Copernicus, Galileo, Kepler, Huygens and Newton, whose works are printed and distributed, providing an atmosphere where the knowledge becomes accessible. Still, the scientific works were created, especially in the beginning of this period, in a manner quite different from that used by the modern science. Before the creation of first scientific institutions, in the beginning of 17th century, and even later, it was usual that at each important court the reigning prince has his courtly mathematician, astronomer or philosopher. The examples are Tycho Brahe and then Kepler at the court of the emperor Rudolf II, and Galileo at de' Medici court. Even in the second half of the 18th century, we find William Herschel, the discoverer of the planet Uranus, in the service of the English king George III. In the beginning, the scientific disputes were hold in the form of letters exchanged by scientists, sometimes printed in the form of books dedicated to their prince-patron. For the output of the debate it was not most important, as it is today, to have good arguments. It was also necessary to please a court and to contribute to the glory of the patron. This is best illustrated by the relationship of Galileo with his first patrons, dynasty of de' Medici, and by his tragic end, explained by some authors as "fall of a favorite" at the court of the Pope Urban VIII (Westfall 1989, Biagioli 1993).

2. EARLY YEARS

Galileo Galilei was born in Pisa 1564, and got his name after his famous ancestor, Galileo Buonaiuti, who used to teach and practice medicine in Florence during the early 1400s. The family name was changed in his honor to Galilei. Galileo also studied medicine at the University of Pisa for two years, before he decided to turn over to mathematics and physics, his true passion. Although he never obtained a university degree, this was not an obstacle to him to work as a professional mathematician in Florence. Having impressed by his talent several well-known mathematicians, Galileo got in 1589 a position at the Pisa University, where he stayed until 1592, when he left Pisa for the chair of mathematics at the University of Padua. Leaving his native Tuscany for the Serene Republic of Venice, he made there numerous friends belonging to the intellectual and cultural elite. The applied mathematics and fundamental research of nature's law practiced by Galileo in this period were complemented by a third component. After 1604, this was an intensive search of a powerful patron: at the court of de' Medici or Gonzaga. His later nomination as court philosopher was the result of the long-term strategy aimed at young Cosimo de' Medici, future Grand Duke of Tuscany. But this strategy was possible due to Galileo's original inventions and great scientific discoveries. The first book of Galileo, on his geometrical and military compass, (Galilei 1606) was dedicated in 1606 to sixteen years old don Cosimo, who became the previous summer the most prominent Galileo's pupil. The position of court philosopher would not only be profitable financially, but also the establishment of an exclusive and durable relationship with a powerful protector would introduce Galileo in the circles of aristocracy. This would provide him a high position that could be transferred from his social identity to the discipline he practiced. In this way the epistemological status of the discipline and methods he used would be promoted. However, his plans were not realized until 1610.

The years 1609/1610 were the years of the turnover in Galileo's life. This came with his success in improving a Dutch invention, the spyglass. Refining the optical design of the telescope (as a Greek astronomer later renamed the instrument), Galileo traveled from Padua to Venice to amaze the Doge and the entire Venetian Senate with its performance. In return, he obtained from the Senate a life contract with the University of Padua, and much raised salary.

Building even more powerful models, with magnification of twenty, Galileo was able to see what no human eye had seen before him, and to revolutionize the study of astronomy. He began with the Moon, and found that "it is like the face of Earth itself, with chains of mountains and depths of valleys".

Then he turned to stars, and became first to distinguish further planets from "fixed" stars. In the beginning of 1610, he fell on the most extraordinary discovery: four planets "Never seen from the beginning of the world right up to our day", in orbit around the planet Jupiter. Soon, these discoveries were presented in a new book, titled *Sidereus Nuncius* or *The Starry Messenger* (Galilei 1610). The book was a true sensation in the whole Europe. (Sobel 1999, The Galileo Project 2007).

3. IN THE ORBITS OF THE MEDICEAN STARS

In the meantime, great changes occurred at the court of de' Medici. After the death of his father, Grand Duke Ferdinando, the young Cosimo, now Cosimo II, ascended the throne. Galileo dedicated his new book to Cosimo, and send it together with his own superior telescope. In the very flattering for the prince dedicatory note, Galileo took upon himself to name the planets the Cosmian stars. But Cosimo preferred the name Medicean stars-one for himself and one for each of his three brothers. For all this, the prince expressed his thanks by nominating Galileo "Chief mathematician of the University of Pisa and philosopher of the Grand Duke".

In Florence, Galileo made new sensational discoveries. He observed dark spots on the Sun, and then phases of Venus, similar to those of the Moon. All these observations supported the heliocentric cosmos of Copernicus, a theory very unpopular at this time, as contradictory to the Holy Bible, and for which the experimental evidence was lacking.

The discoveries of Galileo presented the beginning of a proof. The movement of the Medicean stars showed that the satellites could circle around other heavenly bodies, not only around the Earth. The phases of Venus showed that at least one planet must travel around the Sun. The dark sunspots spoiled the perfection of a heavenly sphere.

However, at de' Medici court the discoveries of Galileo did not have only the astronomical significance. As mentioned in the dedication of *The Starry Messenger*, the Moons of Jupiter were the monuments to de' Medici dynasty, monuments that could be seen from any place on Earth - with a good telescope, of cause. A deeper cause for the enthusiasm of de' Medici family laid in the mythology of this dynasty, starting from Cosimo I in 15th century. Their logo was ΚΟΣΜΟΣ ΚΟΣΜΟΥ ΚΟΣΜΟΣ, relating Cosimo to Cosmos. As the head of the dynasty, Cosimo identified himself with the planet Jupiter, named for the king of the Roman Pantheon. Therefore, although Galileo could dedicate newly discovered planets to any patron, de' Medici were in the position to most appreciate, and reward the mythological meaning of Galileo's discovery (Sobel 1999, Biagioli 1993).

4. RISE AND FALL AT THE ROMAN COURT

The fact that de' Medici were Galileo's patrons did not mean that they supported all his opinions. As a social system based on honor and status, the patronage could not allow to the patron-protector to take somebody's side in a debate. The prince-patron was above this, without risk to endanger his own status. This was also true for Galileo. Although he was in their service until the end of his life, in the moment of the most dangerous crisis de' Medici held them at the safe distance from Galileo. But that moment did not yet arrive. Feeling the danger that his attitude could be proclaimed as heretic, Galileo realized that he should defend his reputation in the centre of events - in Rome. This was also the beginning of a search for a new, parallel patronage - that of the Roman papal court.

Galileo's visit to Rome in 1611 was a complete success. Many cardinals, prelates and princes received him. The famous Jesuit's Collegium Romanum organized a re-

ception in his honor. On this occasion, Galileo met the young marquis de Montecelli, Federico Cesi, the founder of the first scientific society, Academia dei Lincei (1603). Cesi, who will be the longtime friend of Galileo, offered him to become the member of this Academy, by which Galileo books would be printed. During this sojourn Galileo also met the cardinal Maffeo Barberini, future Pope Urban VIII. The next visit to Rome was in December 1615, when Galileo arrived with a new theory supporting the Copernican cosmology. However, this was not a good moment for that. In the spring of 1616, while Galileo was still in Rome, black clouds of heresy hung over the Copernican teaching. At the request of the Pope Paul II, the cardinals of the Holy Office proclaimed that the Copernican doctrine is not only formally heretic, but in direct opposition to the Holy Scripture. This was followed by the proclamation of the Congregation for the Index, by which the Copernicus's book (Copernicus 1543) *On the Revolutions of the Heavenly Spheres* (or *De revolutionibus*, as it usually called) was suspended, until the necessary corrections were made, so that that teaching could not be spread out to harm the catholic truth. Galileo's book *Letters on the Sunspots*, (Galilei 1613) however, was not mentioned. The manuscripts of some other yet non-published Galileo's books, on the Pope's request, were reviewed by the cardinal Roberto Bellarmino. He was an old acquaintance and admirer of Galileo, and he gave to him a signed certificate that granted Galileo the right to discuss the Copernican doctrine only in a hypothetical form. This document would be of great importance during later trial of Galileo. For the time being, Galileo stayed the most brilliant person in Italian science, as well as the representative of the court of de' Medici. Back to Florence, Galileo continued his research in physics and astronomy. The scientific dispute between him and father Grassi from Collegium Romanum, provoked by the appearance of three big comets in 1618, and by the pressure of the patronage system for the explanation, resulted in Galileo's new book, *Il Saggiatore* or *The Assayer*.

In the meantime, several things that would strongly influence Galileo's life happened. In 1621 died Cosimo II, only thirty years of age, leaving the Grand Duchy of Tuscany to his oldest son, ten-year-old Ferdinando II. The boy also inherited Cosimo's chief mathematician and court philosopher. The same year died cardinal Bellarmino and the Pope Paul II. His successor, the Pope Gregor XV, also died in the autumn of 1622, when the printing of *The Assayer* was almost finished. His heir was Maffeo cardinal Barberini, as the Pope Urban VIII. The prince Cesi and other members of the Academia dei Lincei realized quickly the importance of new political development, and decided that Galileo's new book, (Galilei 1623) that was going to be printed by the Academia, should be dedicated to the new Pope. In this way the Academia dei Lincei and Galileo himself were launched in the orbit of a new patron-at the court of Urban VIII. Since the Popes did not have the biological successors, they tried to employ all their power and resources to find, using the patronage system, the followers which would help them to create and keep the best image of themselves. This situation was very convenient for Galileo, who was on very good terms with the actual Pope, having exchanged friendly letters with him starting with 1611, when Maffeo Barberini was still a cardinal. The election of new Pope was for Galileo a *mirabil congiuntura*, as he expressed himself in a letter to prince Cesi. This could bring about

important changes, in the first place regarding the Copernican astronomy.

Galileo thought that the time has come to realize his great project, about which he dreamed since his first discoveries in Padua. This would be a book about the system and the composition of the Universe. To test this possibility, Galileo undertook a new trip to Rome in the spring 1624. Still using the privileges at the court of de' Medici and receiving the regular salary from the University of Pisa, Galileo was trying to enter into Urban's good graces. This seems to be successful: he received from the Pope, among other privileges, a very flattering letter to young Ferdinando. Encouraged, Galileo decided to make a probe, before starting the planned book. He did it in the form of the replay to an anti-Copernican, father Ingoli. He proceeded very carefully, claiming that his aim was not to defend an opinion, which was proclaimed doubtful and contrary to the doctrine superior to physical and astronomical disciplines. Galileo pretended to show to Protestants, e.g. famous astronomer Kepler, that Italian astronomers could admire Copernicus in the theoretical plane, rejecting his teaching from the theological point of view. The manuscript reached the Pope only in December. However, there was no unfavorable reaction, on the contrary.

Encouraged by the novel atmosphere in Rome, Galileo decided to renew debate on the merits of the Copernican system, taking care to present it as one possible theory, in form of a book, *Dialogue Concerning Two Chief World Systems, Ptolemaic and Copernican* (Galileo 1632).

Galileo was occupied with writing the *Dialogue*, with some interruptions, for the period of six years, from 1624 to 1630. However, this work was the product of decades of thinking and research, so that it could be regarded as his- up to this time-life work. The book has the form of a play in four acts, with three personalities expressing their points of view during four days. One of them, Salviatti, expressed the ideas of Galileo, willingly accepted by Sagredo, whereas Simplicio was on the side of Ptolemaic and Aristotelian philosophers.

Galileo first planned to publish his book in Rome, through Academia dei Lincei. The Pope's permission would require only that the contending views should be expressed hypothetically and not absolutely. The Vatican's chief licenser, Father Riccardi, demanded several changes in order that the book would be more consistent with the Pope's position. However, in summer 1630 Prince Cesi died and Academia dei Lincei entered a crisis. On the other hand, the epidemic of plague made it practically impossible to bring the manuscript from Florence to Rome. Eventually, after numerous complications, *Dialogue* was printed in Florence at the beginning of 1632. The book was met with great success and sold quickly in the shops of Florence. However, when the copies reached Rome, some Jesuit astronomers reacted violently and the book provoked the Pope's fire. Urban VIII ordered the book to be taken out of the circulation, and handled the matter of Galileo's possible wrongdoing first to a special commission and then to the Inquisition, which demanded that the Galileo presents himself in Rome. Poor health and age of Galileo made this trip virtually impossible; the inquisitors disregarded the report of a medical commission, and declared that Galileo should come to Rome of his own free will, or he will be arrested and dragged there in irons. Finally Galileo arrived in Rome in February 1633.

The trial of Galileo began in April and concluded in June. However, in the very beginning, something did emerge, unfortunately to the Holy Office. Because of the papal power invested in the trial, Galileo was expected to confess his guilt, not to argue. But he has an effective self-defense in the signed by cardinal Bellarmino document from 1616. This could jam the juridical strategies of the Inquisitors. Thus the Holy Office decided to negotiate with Galileo privately and put him under the pressure until he was forced to recite and sign his abjuration. Galileo was condemned to formal imprisonment and to the recitation of penitential psalms for three years. He was found

” Vehemently suspected of heresy, namely for having held and believed a doctrine, which is false and contrary to the divine, and Holy Scripture: that the Sun is the center of the world and does not move from east to west, and the Earth moves and is not the center of the world, and that one may hold and defend as probable an opinion after it has been declared and defined contrary to the Holy Scripture”

Eventually, Galileo was allowed to go back home to Arcetri near Florence, where he remained under house arrest until his death in 1642. (The Galileo Project 2007, Sobel 1999, Biagioli 1993).

5. DISCUSSION AND CONCLUSION

The interpretation of the sentence is not as clear as it seems to be. It is difficult to evaluate the role of personal friendship or hostility towards Galileo by the Pope, in the congregation Holy Office, and among the theologians and mathematicians of the religious orders, or the effect of the political context on Urban’s decision. A new light on the destiny of Galileo shed the works of Westfall (Westfall 1989) and Biagioli (Biagioli 1003).

As Biagioli describes it, in the 17th century the patronage was not an ”option”. It was the key to social status, a career and social mobility was impossible without patronage relationships. As we have seen, Galileo had a court position at the court of de’ Medici in Florence since 1610, but Maffeo Barberini’s election to the pontificate in 1623 made him think about marvelous new possibilities. Although Galileo was not a local courtier at papal court, he was well connected with it and visited it every few years. He had a special relationship with Urban VIII until 1632 when something similar to the ”fall of a courtier” happened. Although there is no doubt that Galileo insulted the Pope by having the stupid Simplicio in the *Dialogue* express the doctrine of God’s omnipotence, it seems that the political moment was the most important in the condemnation of Galileo and his great work. The past several years have been very difficult for Urban VIII. His role in Thirty Years War was far from successful. In particular, the Spanish and the Roman Holy emperor accused him of favoritism towards the French and weakness towards heretics in Germany. The political crisis made the Pope very sensitive of any accusation of leniency towards heretics, among whom some people could have put Galileo. Urban’s rage and accusation of betrayal were nothing else but attempt to erase his own involvement in the scandal. Galileo’s actual patron, Grand Duke Ferdinando de’ Medici, was the only person who could

try to support Galileo's claims that he had done nothing wrong, as the publication of the *Dialogue* was approved by Roman and Florentine censors, and indirectly from the Pope himself. However, the Pope threatened the Grand Duke that he should not let himself represented as an impious prince supporting a potential heretic.

The rest of Urban's pontificate was also politically controversial and financially bad for Papal States. Although cosmological, theological and juridical arguments were the issues debated at Galileo's trial, their logic was that of the power image of an absolute prince. The logic of patronage helped Galileo to climb social ladder, but also led to its inexorable fall. Since Rome was the seat of the most important princely court of Italy of that time, it was also the place where the patronage conjectures played the most important role. (Biagioli 1993).

The end of the patronage system came with the creation of the scientific societies, such as Accademia del Cimento in Italy 1657, British Royal Society in 1660, and French Academie Royale des Sciences in 1666. This was accompanied by new scientific practices. Rather than on notability of a patron, scientific credibility became based on experiments as a fundamental practice, providing the most effective way to produce new knowledge. This was the beginning of the modern science.

References

- Biagioli, Mario: 1993, *Galileo, Courtier*, Chicago, the University of Chicago Press.
- Copernicus, Nicolaus: 1978, *On the Revolutions* (originally printed 1543 in Nuremberg). In *Complete Works*, Ed. by J. Dobrzycki, Vol. 2. Warsaw-Krakow: Polish Scientific Publishers.
- Galilei, Galileo: 1960, *The Assayer*. In *The Controversy on the Comets of 1618*, by Galileo Galilei, Horatio Grassi, Mario Guiducci, and Johannes Kepler (originally printed 1623 in Rome). Philadelphia, University of Pennsylvania Press.
- 1967, *Dialogue Concerning the Two Chief World Systems* (originally printed 1632 in Florence). Berkeley, University of California Press.
 - 1957, *Letters on Sunspots* (originally printed 1613 in Rome). In *Discoveries and Opinions of Galileo*, New York, Anchor.
 - 1978, *Operations of the Geometric and Military Compass* (originally printed 1613 at Author's home in Padua). Washington, Smithsonian Institution Press.
 - 1980, *Sidereus Nuncuis* or *The Starry Messenger* (originally printed 1610 in Venice). Chicago, the University of Chicago Press.
- Sobel, Dava: 1999, *Galileo's Daughter*, Walker Publishing Company, USA.
- The Galileo Project, 2007, <http://galileo.rice.edu/>
- Westfall, Richard, 1989, "Patronage and the Publication of the Dialogue", *Essays on the Trial of Galileo*. Vatican City, Vatican Observatory.