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A documentary study of the letters exchanged between Galileo Galilei and the Prince Federico Cesi

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Abstract
This paper aims to study the intrinsic everyday relationships between Galileo Galilei and Prince Federico Cesi. In literature, it is possible to find other works that discuss the importance of the history of science to understand its construction throughout historical periods, one of them is the book *Codex Cigoli-Galileo: Science, Art and Religion in a Copernican Enigma*, which discusses these relationships during the Renaissance. During this period, reason and nature began to be valued more intensely, and Renaissance man, especially scientists and artists, began to use experimental methods and methods of observation of nature and the universe. While in the Middle Ages man's life should be centered on God - theocentrism, from the Renaissance onwards man became the main character in his own story. Based on studies from this period, we sought to understand the complex relationships in the construction of scientific knowledge during the period of correspondence exchanges between Galileo Galilei and Prince Federico Cesi, taking into account the influences of the Catholic Church and the society that surrounded them. This work is of a documentary nature, with the translation and analysis of four primary source letters exchanged between Galileo Galilei and Prince Federico Cesi. To this end, we seek to answer the following research question: What concepts contained in the letters exchanged between Prince Cesi and Galileo Galilei during the Renaissance contribute to the process of construction of scientific knowledge? During his research and with the help of other Lynces, Galileo significantly improved the refracting telescope, and with it he observed sunspots, the mountains of the Moon, the phases of Venus, the four satellites of Jupiter, the rings of Saturn and the stars of the Milky Way. The new science proposed by Galileo contributed significantly to the defense of heliocentrism, one of the most debated and censored theories of that time, marked by the execution of Giordano Bruno and the imprisonment of Galileo Galilei.

Keywords: Renaissance, history of science, prince federico cesi, galileo galilei, carteggio

Introduction

This paper presents the unpublished translation into Portuguese of the correspondence between Prince Federico Cesi and Galilo Galilei. The Carteggio was written between July 23, 1611 and November 30, 1613. During this period, 71 letters were found, seven sent by Galileo and 64 sent by Prince Cesi.

The organization of these letters began with the research work carried out by two of the authors of this article at the Warburg Institute of the University College of London and continued at other institutions, such as the Istituto e Museo di Storia dela Scienza (Galileo Museum) in Florence, Italy, the Istituto per gli Studi Filosofici in Naples, Italy, and the Università La Sapienza di Roma (SILVA *et al*, 2015) [16].

During the translation and reading of the letters, one can find aspects related to the daily lives of the prince and the scientist, in which they demonstrated a strong friendship. Furthermore, there are several discussions about the lunar observations that Galileo carried out, in addition to an academy of scientists, artists and philosophers that was emerging, at the time founded under the name of *Accademia dei Lincei* (Academy of the Lynxes).

The two men are united by bonds of friendship, mutual trust and support for the new experimental research that Galileo was unveiling with his studies involving especially Astronomy and a new Mechanics. At this time, it was the patrons who financed research related to science and art in general. They were wealthy gentlemen, powerful merchants, princes, counts, bishops, bankers and doctors who financed and invested in the production of science and art in order to obtain recognition and prestige from society. The best known were the Medici, a family of doctors and bankers who financed much of the research and Arts during this period (SILVA & NEVES, 2015) [10, 16].

The objective of this paper is to understand the complex relationships in the construction of scientific knowledge during the Renaissance. To analyze the influences of the Catholic Church on the development of Galileo's science, in addition to understanding the importance of interdisciplinarity during the development of this science and identifying the importance of these concepts in the construction of a new scientific paradigm and the Revolution that Galileo was about to unleash (KUHN, 1987) [7]. However, the science accepted and practiced in our contemporary world is fragmenting every day, as a result of a profoundly positivist proposal that has completely Cartesianized knowledge. A good example are schools at all levels, characterized by several disciplines separated by areas of knowledge that do not interact with each other. For this reason, this translation into Portuguese of four letters (*carteggio*) between Cesi and Galileo aims to understand the contingencies of life and the definitions of the construction of scientific knowledge, in order to contribute to the understanding of this development, and to understand science as something homogeneous, that is, that depends on all areas to develop (NEVES *et al*, 2015) [10].

Silva & Neves (2015) [10, 16], 31 (thirty-one) letters exchanged between Galileo Galilei and the painter Lodovico Cardi, also known as Cigoli, were translated into Portuguese for the first time. Similarly, for the purposes of this article, it is possible to find in this work significant interdisciplinary dialogues between a scientist and a painter. This great friendship would become even more notable in the series of solar observations that Cigoli, together with his friend

Passignano, later composed the imagetic description of the Sun and its rotation expressed in the book *Trattato sulle macchie solari ed i loro incidenti*.

With this scope, we seek to answer the following research question: What concepts contained in the letters exchanged between Prince Federico Cesi and Galileo Galilei during the Renaissance contributed to the process of constructing scientific knowledge? In the search for an answer, it was necessary to better understand the Renaissance period in order to understand the influences on the interpretations of the world and the universe during that period. It was also necessary to know the biographies of Prince Cesi and Galileo in order to understand the scenarios in which they were both immersed, in addition to research related to the *Accademia Nazionale dei Lincei* (National Academy of Lynxes), which was founded in 1603.

During the analysis, a translation and comparison of the events that appeared in the letters was carried out, such as historical facts, in order to complement the ideas, providing a better understanding of the whole.

Research Methodology

This section describes the processes used during the research, highlighting its methodological path and the theory required for the analysis regarding documentary research.

Methodological Path

After coming into contact with the book *Codex Cigoli-Galileo* (Silva & Neves, 2015) [10, 16], during the disciplines of Seminars I and II of the PCM - Postgraduate Program in Education for Science and Mathematics at the State University of Maringá, a great deal of reflection was carried out regarding two main points:

The first of these concerns the historical analysis through the carteggio (exchange of correspondence) between Lodovico Cardi, better known as Cigoli, and Galileo Galilei. It consisted of documentary research based on materials extracted from primary sources, contributing to understanding the science accepted today by the scientific community, in addition to showing us that science is constructed in an interdisciplinary manner, as in the present case, between a painter and a scientist, respectively.

The second point is the expansion of these interdisciplinary (or transdisciplinary) discussions, in which science is not and has never been finished and, in this case, interdisciplinarily linked to art. Thus, the proposal here is the unprecedented translation into Portuguese of new letters, preparing rich material in the search for an understanding of a more complete and non-fragmented science.

It was then necessary to have access to the letters exchanged between Galileo and other scientists, artists and the financiers of his research, in order to decide which exchange of correspondence could be considered valid for the research:

The letters were collected from the Edizione Nazionale of Galilean works produced by Antonio Favaro, and published in Florence in 1890. The Opere was made available (complete edition) through the portal of the Museo Galileo in Florence (http://www. museogalileo.it/). (NEVES *et al*, 2015, p.25) [10].

After the initial contact and preliminary analysis of the letters, it was decided that the letters to be analyzed would be those exchanged between Prince Federico Cesi and Galileo Galilei. The choice was made because Cesi believed in and supported Galileo's research, and for this reason it was possible to identify rich material for analysis in his speeches, which could contribute to the concepts about the Moon already discussed in the book The Codex, however, now from another perspective:

The translation of classical works of philosophy and science from the past is not only necessary. It is indispensable. However, on the condition that the translations are correct and exact. For if they are not, and if, moreover, they are used without a critical spirit by renowned historians who thus cover them with their authority, their existence could have deplorable consequences. Indeed, error is worse than ignorance. However, if translating any text is already a difficult task, translating scientific works from a time other than ours carries a very serious additional risk: that of involuntarily substituting our own conceptions and habits for conceptions and habits that are completely different from those of the author (KOYRÉ, 1991, p.256) [6].

After the selection, the translation work of the letters that were in Italian began. The translation work was one of the most important moments during the research. After its completion, the analysis of the letters began. For this purpose, documentary analysis based on Ludke and André (2013) [9] was used.

Documentary Research

In this work, documentary research was used. This is characterized by the study of documents that have not yet been treated or that can be studied seeking other forms of interpretation. For Ludke and André (2013) [9], this research can be a very important technique when dealing with qualitative data, as it complements or reveals new themes and/or new problems.

Documentary research differs from bibliographic research. According to Lakatos and Marconi (2010) [8], bibliographic research is characterized by the study of secondary sources, that is, it covers all the bibliography already published on a given topic, putting the researcher in direct contact with everything that has already been written and said. Documentary research, on the other hand, differs by the use of primary sources, that is, the researcher has direct contact with the data and not with the studies done on this data.

The Renaissance

The Renaissance was a historical period that enabled important achievements and advances in science for its time. The main aspects of this historical period for this work are related to the influences of everyday life and religion, in which the characters Federico Cesi and Galileo Galilei were inserted during the process of construction of science and the Scientific Revolution that would characterize the period that goes from the publication of "De Revolutionibus orbium coelestium" by Nicolaus Copernicus to the seminal works of Galileo himself.

The Renaissance emerged in Italy around the 14th century and soon spread to other countries in Europe. This was a great movement of renewal in philosophy, science and art. The first record of the term was made for the first time by Giorgio Vasari in the mid-16th century; however, the baptism of this period by the name as we know it today can be found in the work The Culture of the Renaissance in Italy (1867) by Jacob Burckhardt.

One of the main reasons why it began in Italy was because the leaders of the States – largely represented by popes, princes and bourgeoisie – "protected" people who were linked to art and philosophy. With the arrival of the Renaissance, man became concerned with developing his body and spirit and had a great interest in knowing a little about everything, placing himself at the center of what until then, in the Middle Ages, had been occupied by God.

The Renaissance Context

According to Silva & Neves (2015) [10, 16], men think according to the possibilities of their time, and that is why it is important to seek the context of the Renaissance to understand the scenario in which the two characters analyzed here lived: Cesi and Galileo.

Before the Renaissance, during the Middle Ages, the Catholic Church influenced almost all of society: politics, economy, education, art and science (HALE, 1970) [5]. The main characteristic of this period was the strengthening of the rural economy and the enrichment of the Catholic Church (especially with the sale of indulgences and the seizure of assets of those convicted of heresy by the Inquisition). However, in Italy some cities such as Genoa, Venice and Florence became rich by holding the strength of commercial power in the region due to a political model adopted that guaranteed political and economic independence to these cities (SILVA & NEVES, 2015) [10, 16], with City-States that could stand up to papal power.

Education at the time was heavily influenced by religion, and only representatives of the clergy and the children of nobles had full rights. The rest of the population did not have access to education. Due to this education being aimed at the privileged classes and heavily influenced by the Catholic Church, artistic and cultural production was largely concentrated in religious spaces.

During the Renaissance, it was necessary to seek more practical training, contradicting the theological education of the Middle Ages. For Hale (1970) [5], the changes of this period are clarified by the new teaching proposal in which teachers left behind the medieval idealization of poverty (for the people), celibacy, and seclusion.

In these new times, family life and the wise use of wealth were valued. Furthermore, it was possible to clearly see the relationship established between education and issues related to culture and the Humanities (SILVA & NEVES, 2015) [10, 16].

For Woortmann (1997) [17], the Renaissance transformed the current world through two revolutions that stood out the most. However, these were not necessarily related. The first was linked to Astronomy, associated with Nicolaus Copernicus and his book De Revolutionibus Orbium Coelestium, and the second was linked to geography, associated with Cristoforo Colombo (GONÇALVES, 2018) [4].

Already in the 16th century, countries that turned to great navigation began to become rich and, along with this economic development, the culture and art of these countries also developed. Through these economic, political and cultural transformations, the thinking of the period was able to be modified: the world of the Renaissance was no longer immobile as in the Middle Ages.

According to Silva & Neves (2015) [10, 16], during the Renaissance, man became the center and religion remained present, but with a different approach. The new man becomes the interpreter of Nature, in all its areas of knowledge. For Argan (2003, p. 21) [1]:

[...] it is no longer the revelation of eternal truths, but the search for God in the human soul; it is no longer obedience to an authority, but the choice that implies the individual's responsibility before God. Analogously, the new science is no longer wisdom transmitted and founded on the authority of ancient scriptures, but a constant inquiry into reality, understood as an ever-open problem. Politics is no longer the formation of a hierarchy of powers that derive from God, but the struggle of forces in search of a provisional balance.

The Renaissance drastically changed the way society interpreted the world, taking into account religion, science, politics and art. During the Middle Ages, there was a false dialogue between science, art and religion. False because the Scriptures were supposed to have the final word. However, this ceased to occur during the Renaissance, and there was a break in this pseudo-harmony, with science moving away from religion, generating new questions and new searches for answers (FAURE, 1975) [3].

Dialogues between Science and Religion in the Renaissance

During the Renaissance, discussions about religion and science increased and diverged drastically, joining the crisis of the Reformation. This fact accelerated the transition to modern science.

The beginning of the Renaissance, science was still dependent on religion, that is, the Church held the power to define which science could be practiced (as long as it was based on the Aristotelian-Thomistic system), based on ideas of the centrality and immobility of the world, with the universe subdivided into two worlds: the sublunary world and the supralunary world (FAURE, 1975) [3].

With the concepts refined from Aristotle by Saint Thomas Aquinas, science was left to the ballast of Faith. The impediment to divergent thinking could find in the Inquisition an insurmountable obstacle to any transformation in the prevailing Ptolemaic paradigm. This fact is noted in Copernicus's fear of publishing his Re Revolutionibus, in the arrest and execution of Giordano Bruno, in the long imprisonment of Tommaso Campanella and in the house arrest of Galileo Galilei. However, the Renaissance world, scale for an interpretation of man over that given by faith regarding the phenomena of nature (WOORTMANN, 1997) [17].

Between the 15th and 16th centuries, a dispute arose between the ideas that emerged between religion and a science on new bases. In the 16th century, there was already a mixture of Classical Antiquity with medieval Christianity and popular paganism. However, many of the intellectuals linked to science were part of the clergy and, therefore, did not disassociate themselves from their religious faith. Many of them believed that they should reform the Church, change its ideas, bring new knowledge, but all this by uniting religion and science (FAURE, 1975) [3].

The Ecumenical Council of Trent was held between 1545 and 1563, the longest in the history of the Church. Until that time, this institution demonstrated a certain tolerance towards men of science and their heresies, but not out of permissiveness, but because Copernicus' heliocentrism did not seem to threaten religious dogmas, especially because the anonymous preface to the book *De Revolutionibus*

orbium coelestium (later attributed to Osiander, and written and published without Copernicus's own authorization) assured this. While in Rome there was more tolerance towards science, including from the Pope, in the peripheries there was more rigor regarding scientific discoveries (WOORTMANN, 1997; HALE, 1970) [5, 17], perhaps due to a more efficient performance by the Inquisition.

Copernicus was, therefore, a kind of example of this religious tolerance. Initially he was encouraged by the Church and, later, his work was condemned by the Reformation. Copernicus wrote a letter to Pope Paul II to explain that the system he had created still maintained the perfect organization of the universe, with the circular movement of the planets and the symmetry of the celestial bodies. In other words, his system sought to confirm the theological order through circularity, sphericity and symmetry. As can be seen, Copernicus' ideas-maintained traces of the ideas and religiosity of the Middle Ages in his studies (WOORTMANN, 1997; HALE, 1970) [5, 17].

Despite the criticism, some reformers defended Copernicus' ideas, emphasizing that his Astronomy maintained theological principles by maintaining the uniform circularity of the orbits. However, with Giordano Bruno, the proposals made by Copernicus became more evident. Bruno was accused of heresy, hermeticism and the cultivation of memory as an instrument of magic. For these reasons, Bruno was sentenced to expulsion from the Dominican order (WOORTMANN, 1997) [17].

According to Silva & Neves (2015) [10, 16], Bruno highlighted the following differences in his theory: "[...] the idea of an infinite universe in space and time, in addition to an animistic universe and the idea of a stained Mary, mother of Jesus". This thought by Giordano Bruno and many others who lived in this period, such as Galileo Galilei, contributed to the transition from Aristotelian-Thomistic philosophy to modern science, however, always with several setbacks before the authority of the Church and its long and reckless punitive arm, the Inquisition (FAURE, 1975) [3].

In the second half of the 17th century, it was already possible to identify great differences between faith and knowledge, as well as the world of matter and spirit. The world was adjusting to the notion of natural laws, creating conditions for theologians to give way to scientists (WOORTMANN, 1997) [17].

For Hale (1970) [5], in the Renaissance, the theologian gave way to the scientist, man took a prominent place in creation, became free, and was able to think and choose for himself, as a unique and individual being.

The Scientific Contribution of the Renaissance

For Koyré (1991) [6], talking about the contributions of the Renaissance may seem paradoxical, and it would take a lot of boldness to raise these discussions. This is because the Renaissance was a time of great wealth, especially in relation to the image that was formed of the universe, the *Imago Mundi*. The ideal of civilization of the time, called the Renaissance of Letters and Arts, became an ideal of rhetoric, far from the ideal of science that was sought. Thus, the character who embodies the spirit of the Renaissance is the great artist, as well as the man of letters. It was these men and women and the scholars who sacrificed themselves in search of announcing a new science that sought to leave the traditional world imposed by the superiors of the Church. On the other hand, during this period there was still little criticism in works that were consumed by readers who were still specialized. It was a time of profound superstition, in which beliefs in witchcraft and magic expanded beyond the Middle Ages. The greatest successes consumed were not in translations of the classics, but rather in books with subjects related to demonology and magic, just as astrology played a greater role than astronomy.

According to Koyré (1991) [6], the great enemy of the Renaissance, from a philosophical-scientific point of view, was the Aristotelian-Thomistic synthesis itself, and it can be said that, paradoxically, his work was the destruction of this synthesis. In other words, credulity and belief in magic and witchcraft are direct consequences of this destruction. As a result of these practices, Aristotelian Physics, Metaphysics and Aristotelian ontology were destroyed, ending the possible rules for deciding whether something was scientifically possible or not.

If one were to summarize the mentality of this period in one sentence, it would be: "everything is possible", and this for two reasons: the first, due to the intervention of supernatural forces to give meaning to events; and the second, in the refusal of the intervention of supernatural forces, to affirm that everything is natural and that even the most bizarre facts could be explained by an action of nature. Naturalism in the Renaissance emerged from these discussions about the magical naturalization of the supernatural (KOYRÉ, 1991) [6].

A good example is the collections of botanical drawings, which reveal an important vision of artists and scientists. It is possible to find Dürer's drawings, Gesner's collections, and Aldrovandi's encyclopedia, which contain, in addition to images, stories about the power and magical action of each plant. What is missing from these works is a theory of classification; the works do not go beyond the stage of catalogs. This characteristic ends up being repeated in other segments of science, such as in travels for Geography and descriptions in the study of the human body (KOYRÉ, 1991) [6].

Regarding scientific evolution, the fact exposed by Koyré is repeated that the destruction of the Aristotelian synthesis constitutes the necessary basis for this evolution. Bréhier (apud Koyrè (1991) recalls that:

[...] in the Aristotelian synthesis, the world forms a well-ordered physical Cosmos, a Cosmos where everything is in its place, in particular the Earth, located at the center of the Universe, by virtue of the very structure of this Universe. It is evident that the destruction of this conception of the world was necessary so that heliocentric astronomy could take flight (KOYRÉ, 1991, p. 50) [6].

In Physics and Aristotelian Cosmology, it is the structure of space itself that determines where objects will be found. In other words, by force of its nature, as a gravium (heavy body), the Earth must be at the center of the world. However, the fact that it is at the center does not mean that there is something present at that point, or that there is some physical force that attracts heavy bodies: they move towards the center simply because it is the force of their nature. For Astronomy, this fact refers to the structure of physical space: it is its very nature that determines the place and movement of the stars (KOYRÉ, 1991) [6].

Another important step was taken by Tycho Brahe. Although his concepts were strongly linked to geocentrism, he made contributions to Astronomy and science in general that were new for his time: a spirit of precision synthesized

by the systematic observation of natural phenomena and by the precision in the manufacture of measuring instruments used in astronomical observation with the naked eye. However, this was not yet an experimental spirit, but a spirit of precision in the search for understanding the Universe. Later, the work developed by Kepler would be based on the precise observations of Tycho Brahe (NEVES & ARGÜELLO, 1986) [13]. For Kepler, Tycho Brahe was the one who definitively destroyed the concept of celestial orbits carrying the planets that revolve around the Earth or the Sun and, therefore, imposed on his successors the consideration of the physical causes of celestial movements.

Kepler's major publications were *Astronomia nova sive physica coelestis* published in 1609 and *Epitome Astronomiae Copernicanae* published from 1618 to 1621. The new proposals presented by Kepler refer to the idea of a universe governed by the same laws, and by strictly mathematical laws. Your universe is hierarchically structured in relation to the Sun; However, for Kepler, everything would be harmoniously organized by a creator, following certain mathematical and geometric considerations (KOYRÉ, 1991) [6].

Kepler's failure begins when he does not consider the universe to be infinite, since he is imbued with his idea of a well-ordered world. In this sense, it exposes several criticisms of the intuitions of Giordano Bruno, who, perhaps because he is a philosopher, believes that the reform carried out by Copernicus in Astronomy implies the definitive abandonment of the idea of a structured and hierarchically ordered Universe, in addition to proclaiming the idea of an infinite Universe (NEVES, 2004) [12].

Although Bruno was unable to arrive at the notion of a movement that occurs by itself in an infinite space, he managed to conceive its geometrization and the infinite expansion of the Universe, which became the most important argument during the Scientific Revolution in the 17th century, during the foundation of classical science in the West.

Galileo, in turn, geometrizes the Universe, identifying physical space with that of Euclidean geometry, overcoming Kepler's limitations and not choosing Brunian infinitism. In this way, Galileo was able to formulate the concept of movement that constituted the basis of classical dynamics. Therefore, it is on the basis of Galilean physics that science as we know it was built, completed by Isaac Newton decades after Galileo's death (KOYRÉ, 1991) [6].

The carteggio between Prince Cesi and Galileo

This section will present the unpublished translation into Portuguese of the letters exchanged (carteggio) between Prince Federico Cesi and Galileo Galilei. In all, there are seventy-one letters found and exchanged between the two characters. However, only seven of them are from Galileo to Prince Federico Cesi. This reason can be explained by Galileo's condemnation, and it is possible to believe that Cesi's family destroyed Galileo's letters for fear of the Inquisition.

Prince Cesi collaborated with Galileo's studies and research, especially because he was the founder of the Accademia dei Lincei. Through the translations he made, he sought to understand the daily life between the scientist and the nobleman. This article will only discuss the letters (table) in response from Galileo to Prince Federico Cesi, four letters in total. The letters were chosen because of the amount of information they contained.

Table: Letters exchanged between Prince Federico Cesi and Galileo Galilei

N° of letter	Date	From/To
07	December 16th, 1611	Prince Federico Cesi to Galileo
08	December 19th 1611	Galileo to Prince Federico Cesi
15	May 4th, 1612	Prince Federico Cesi to Galileo
16	May 12th, 1612	Galileo to Prince Federico Cesi

The analyses of the letters appear in the form of notes immediately after their translation. An ascending numerical order was established to organize the notes. The letters will be presented in an unpublished translation into Portuguese, as will the cited notes (*Considerações*, in portuguese).

Federico Cesi para Galileo em Florença
16 de dezembro de 1611

Bibl. Naz. Fir. Mss. Gal., P. VI, T. VIII, car. 65. – Autografi il poscritto e la sottoscrizione.

Muitíssimo e Excelentíssimo Sr. Observantíssimo,

De duas outras [cartas] minhas, que lhe enviei pelo correio de Milão, não recebi resposta alguma, [o que] me fez duvidar se o retorno não está em atraso. Poderá V.Sa. fazer uso de diligência, porque ali haviam muitos particulares sobre os ocorridos ligados aos epigramas[1], que para satisfazê-lo, consegui e tive do Sr. Demisiani: e de qualquer maneira está bem servido, te enviarei novamente uma cópia, junto com duas cartas de dois de nossos Linces. Entenda caro, minha vontade é a de que o céu esteja sempre de bem, trazendo toda sua felicidade. [Dito isto] beijo-lhe as mãos.

O Sr. Porta e estes outros escritores Linces, creio, que logo enviarei à V.Sa. sobre as epístolas[4] [mencionadas]. O Sr. Fabri[5], professor deste estudo de botânica[6], nosso eruditíssimo Lince, dá conta sobre as manchas solares [observadas] na Alemanha. O Sr. Teófilo, jovem de doutrina e fervoroso [e maravilhoso] nas ciências, levou para o estúdio de Ingolstadio com extraordinária provisão de 400 [*dias?*], deseja ser um de nossos Linces[7]: eu contei isso, e são muitos dias [*de observação das manchas*], e estão conforme nosso débito [*troca de experiências?*], honrando-nos. Desejo sobretudo muita saúde a V. S.

Sr. Galileo Galilei.

Afirmadíssimo para servir-lhe sempre

Fed.co Cesi, Mar.se di Mont.li

Ao Muitíssimo e Excelentíssimo Sr. Observantíssimo

Sr. Galileo Galilei.

Florença

Considerações:

1. O termo *epigrama* era de uso comum no latim clássico, que significa qualquer mensagem gravada em cima de alguma obra ou objeto, em forma de grafitagem caligrafada, inscrições, epitáfios e identificação de produção artística. Os epigramas citados por Cesi dizem respeito às manchas solares que estavam em discussão pelos *Lincei* (acadêmicos dos Linces – *Accademia dei Lincei*).
2. Giovanni Demisiani era um grego de Zakynthos, teólogo, químico, matemático do Cardeal Gonzaga e membro da Academia dos Linces. Ficou conhecido por fabricar um telescópio para uma versão do instrumento

apresentado por Galileo Galilei à Academia dos Linces, durante um banquete em homenagem ao ingresso de Galileo na Academia em 1611. Os epigramas de Demisiani, entre outros, foram desenvolvidos para o trabalho de Lagalla.

3. Por mais que os Linces estivessem distantes entre si, as pesquisas desenvolvidas na Academia eram feitas em conjunto, por meio de cartas, nelas havendo suas contribuições.
4. O Príncipe Federico Cesi fundou a Academia dos Linces, talvez por esse motivo ele era um dos maiores comunicadores dentro da Academia. Em geral, todas as cartas passavam por ele e, então, ele se encarregava de enviar a mesma carta para tantos outros Linces, tanto quanto fosse necessário para enriquecer os epigramas em construção.
5. Giovanni Faver, também conhecido por Sr. Fabri, era um médico alemão, botânico e colecionador de arte. Trabalhou no Jardim Botânico do Vaticano como Diretor (hoje atual *Orto Botanico* em Roma) e foi membro e Secretário da Academia dos Linces. Era amigo de Galileo Galilei e seu nome encontra-se creditado como um dos inventores do microscópio.
6. Aqui pode-se perceber o interesse de um professor de Botânica por Astronomia; ele se preocupou em realizar cálculos referentes às suas observações sobre as manchas solares.
7. A Academia dos Linces iniciou os trabalhos com apenas quatro pessoas. Ela passou a ganhar fama e reputação com a entrada de Galileo e a publicação de livros escritos pelos integrantes Linces.

Galileo para Federico Cesi em Roma
19 de dezembro de 1611

Bibl. della R. Accad. dei Lincei in Roma. Mss. n.° 12 (già cod. Boncompagni 580), car. 135. – Autografa.

Ilustríssimo e Excelentíssimo meu Senhor,

Realmente minha indisposição[8] atrapalhou-me em responder subitamente à cortesíssima [carta] de V.Exma., na qual recebi os epigramas do Sr. Demissiani[10], o qual sou muito agradecido e lhe tenho em débito.

A nova [carta] do Sr. Terenzio desagradou-me pela grande perda da nossa companhia, quanto ao encontro para a santa resolução e pela aquisição da outra companhia, para o qual eu tanto devo; sobre isso, agradeço ao nosso V. E. por haver encontrado a agregação do S.r Teófilo, valor o qual vale apenas pelo testemunho de V.E.

Eu me senti feliz que ele tenha lido a carta escrita ao Pai Grembergero[11] com algum gosto, assim como eu não quero conduzir de modo a repugnar alguém, mas apenas dizer as minhas razões e as minhas desculpas. Eu não sei como o Pai tem recibo, então eu não conduzo sua resposta[12]. Eu também faria de bom grado se o S.r Lagalla encontrasse algo de sua própria satisfação, e que diminua alguns escrúpulos [...] Estou esperando com grande desejo a sua escrita em relação a este respeito, enquanto isso *vivo*, como de costume, servo carinhoso.

A última parte dela, especialmente quando o meu estado de perguntas me alerta, não posso dizer qualquer coisa boa, relativo a constituição do meu corpo[13], então eu estou a dois meses com dor renal [quase] crônica e dor no peito, e outras dores intermitentes nas pernas, nos braços e em outras partes, e mais, a quase 15 dias, estou com grande perda de sangue, que tem quase contadas minhas veias e me deixando muito fraco. Eu tenho perdido quase todo o gosto, o apetite e sono; e todos os males referentes a falta de ar, e em particular para aqueles que não fogem totalmente à noite. Estas coisas me perturbam a mente e me causam melancolia, e, em seguida, aumenta todos eles, todavia, vou assim mancando, fazendo qualquer coisa, e dentro de poucos dias vou enviar para V.E. um discurso de certa disputa conduzido para alguns Peripatéticos[14]; e enviado por este, para permitir o atraso por alguns dias a algumas respostas de cartas, não interferindo entre as tantas observações celestes[15], com alguma adição de estranheza. Mas bem que impediu todas as outras operações, eles são experientes nessas observações. Reverencio V.E, por que geralmente vivem o servo mais devotado, e com reverencia beijo suas mãos.

De Florença, 19 de dezembro de 1611.

De V. Ilma.

Servidor Obrigadíssimo

Galileo Galilei.

Considerações:

1. Galileo tinha sérios problemas de articulação desde os 30 anos, desenvolvendo artrite e uma irritação constante quase insuportável nas pálpebras.
2. Galileo estava se referindo ao Príncipe Federico Cesi, quem herdou este título após a morte de seu pai.
3. Galileo se tornou amigo de Demissiani. A amizade se iniciou quando Demissiani contribui com as ideias de Galileo durante a montagem do telescópio.
4. Cristoforo Grembegero foi matemático e Padre, grande amigo de Galileo Galilei.
5. Acredita-se que Galileo mantinha o carinho dos padres em busca de algum benefício, por exemplo, escrever de maneira arbitrária sobre qualquer assunto, como o movimento da Terra e, ainda assim publicar suas pesquisas por mais proibidas que fossem.
6. Os problemas de saúde que Galileo enfrentava foi um dos motivos que o impediu, muitas vezes de aprofundar alguns de seus estudos; inúmeres vezes ele esteve acamado, debilitado para trabalhar em seus empreendimentos científicos.
7. Aristóteles fundou em 336 a.C. a Escola Peripatética que durou até o século IV d.C. Logo, os alunos dessa escola seguiam os princípios filosóficos de Aristóteles, tornando-se seus discípulos.
8. Galileo construiu e desenvolveu seu primeiro telescópio com 20 vezes de aumento, muito mais potente e nítido do que qualquer outro deste período (telescópio inventado originalmente por Hans Lippershey, na Holanda). Com este instrumento ele realizou inúmeras observações da Lua. Já em suas primeiras observações com o telescópio ele pode verificar o relevo lunar, as estrelas da via Láctea e os satélites de Júpiter. Este telescópio está exposto no Instituto e Museu de História da Ciência (“Museo Galileo”), em Florença. Dessa maneira, Galileo buscou quebrar paradigmas de uma ciência dominada pelo modelo aristotélico, segundo o qual todos os corpos celestes, inclusive a Lua, eram esferas lisas livres de imperfeições. As descobertas telecópicas de Galileo, impressas em seu livro *Sidereus nuncius* mostrou que a superfície da Lua não era polida, nem regular e de esfericidade perfeita, mas sim, áspera e irregular, cheia de vastas proeminências e cavidades profundas, semelhante à superfície da própria Terra.

Federico Cesi para Galileo em Florença
4 de maio de 1612

Bibl. Naz. Fir. Mss. Gal., P. VI, T. VIII, car. 98. — Autografa.

Molt'Ill.re et molto Ecc.te Sig.r Oss.mo

Estou com grande esperança sobre a melhora da sua saúde, desde os novos problemas, até aqueles que se arrastam desde Florença, ainda quero muito me apreciar com os seus escritos. Não tenho dúvidas em meus sentimentos sobre sua sequência de conhecimento[16], mas me angustia muito.

Pela graça de Deus, os Linces vão muito bem, o Sr. Porta me impediu de escrever a outros filósofos de Nápoles. Para ele, já temos o melhor e outros não acrescentariam; mas eu ainda não me convenci, penso que a quantidade de cinco[17] filósofos seriam o suficiente. O Sr. Porta tem-se envolvido com outros trabalhos, ele está em busca de um lugar[18] para os Linces, mas até o momento ele ainda não encontrou, mas logo vai encontrar.

Era para Filiis ser admitido nos Linces no último domingo, mas por causa do infortúnio de Fabrizio Cancelliero, que, tendo caído da carruagem no caminho das igrejas e, estando com um braço enfaixado e imóvel em uma cama, não foi feito: em alguns dias ele melhora e assim Filiis será admitido. Nesta noite, alguns Lincei se reunirão para tratar durante muito tempo sobre os epigramas[19] que V.S. me enviou. Entendemos as zombarias que relacionam aos seus adversários.

Estou enviando em uma caixa um catálogo dos Linces: a escritura mostra plantas indianas[20], as de Persio são bonitas, o seu nome aparece junto aos Linces envolvidos. Todos os Linces estão envelhecendo e colocando as suas ideias no papel, eles declararam fidelidade ao grupo[21] e não vão nos abandonar. Eu também estou escrevendo, se as minhas ideias não ajudar em nada, pelo menos mostrará ao mundo o carinho que eu trago pela V.S. sempre com muita verdade. Agradeço por servir a V.S., Beijo suas mãos.

Aff.mo per ser.1a sempre

Fed.c o Cesi, Mar.se di Mont.li

Fuori, d'altra mano: Al molto Ill.re et molto Ecc.te Sig.r Oss.mo

II Sig.r Galileo Galilei.

Con una scattola. Firenze.

Considerações:

1. Príncipe Cesi demonstra confiar na capacidade intelectual de Galileo em desenvolver as suas teorias. ele reconhece o grande gênio de Galileo, mas se preocupava com seu estado de saúde, pois sua debilidade física poderia impedi-lo de seguir com seus estudos.
2. O Príncipe Cesi elevou rapidamente as cadeiras da Academia dos Lincei de 4 para 32. Contudo, sempre que havia um novo membro um membro, Cesi buscava informações sobre a pessoa, além de consultar a opinião dos membros que já inscritos.
3. No início, quando ainda eram apenas quatro *Lincei*, eles se encontravam na residência do Príncipe Cesi, que dispunha de uma biblioteca e de um laboratório com vários equipamentos para desenvolver as suas pesquisas. Com o tempo, os sócios se se dispersaram quase falindo a ideia da Academia. Isto se deveu pelo fato do pai de Cesi se opor às pesquisas de seu filho.
4. Alguns *Lincei* moravam na mesma cidade, facilitando o contato. Quando queriam resolver algo importante, eles passavam uma temporada na casa de algum outro sócio a fim de trabalharem juntos. Quanto as cartas de Galileo, todos *lincei* tinham interesse em ter acesso a elas e participar das discussões.
5. Por mais que fosse matemático e astrônomo, Galileo também demonstrava interesse por outras áreas. Os *Lincei* catalogaram plantas de diversas regiões, como, por exemplo, as plantas indianas, as plantas americanas, as plantas locais, etc.
6. O grupo dissolveu-se, bem antes da morte de Galileo (1642), em 1630 com a morte de seu fundador e financiador das pesquisas Príncipe Federico Cesi, deixando vários trabalhos publicados que colaboraram para a Revolução Científica iniciada e consolidada no Renascimento.

Galileo para Federico Cesi em Roma
12 de maio de 1612

Bibl. Nat. Florença, Mss.

Eu ainda não posso dar novas notícias à V.S. sobre a minha saúde, até porque, continuo indisposto. No entanto, eu estou me cuidando e já comecei a sentir certa melhora[22]. Notei o meu nome como você disse, e agradeço-lhe por esse favor [...] é uma honra ver que estou em um lugar[23] entre homens de tanta excelência. Meu discurso que gira em torno de coisas que estão sobre a água vai ser impresso[24], mas ainda faltam 5 folhas para finalizar. Em 15 dias deverá estar pronto por completo e, assim, vou poder enviar a V.S., Ilustríssimo e Excelentíssimo.

Em seguida, enviarei uma carta que estou escrevendo ao Sr. Marco Velserio em questão das manchas Solares. Nela, estou dizendo minha opinião em torno de três cartas que lhe foram enviadas pelo falso Apelles, que V.S. encontrou em Roma. Sobre estes pontos, eu posso finalmente concluir e, eu acho que posso provar que as manchas[25] são contíguas ao corpo da superfície Solar, onde são gerados e dissolvidos constantemente, precisamente, como nuvens em torno da Terra, essas nuvens são levadas por ai, voltando para o Sol mesmo em um mês lunar, com mudanças semelhantes variando de acordo com os planetas. Este movimento acontece do oeste para leste em torno dos polos da eclíptica: eu imagino que baseado neste desenvolvimento haverá o funeral[26] da pseudofilosofia. Eu já tenho visto sinais nas estrelas, na Lua e no Sol, e agora estou esperando surgir os grandes Peripatos[27] que querem manter a imutabilidade dos céus.

Eu não sei onde eles vão guardar ou esconder[28] o céu, agora que estamos conseguindo manifestações com experiências significativas. Eu espero que as ondas montanhosas da Lua sejam convertidas em gozo, e que as comparações dos flagelos presentes nas nuvens de vapores, também possam ser encontradas no Sol, movendo-se e dissolvendo-se continuamente.

Esta carta que estive escrevendo possui seis folhas, o que será bom para o volume, mas, em outra ocasião, eu quero escrever mais demonstrativamente. A caixa que foi envida pela nota dos Linces chegou em pedaços, por isso vou enviar de volta acomodado em outro objeto, juntamente com algumas observações sobre [as] manchas solares. Excelentíssimo, por favor, quero pedir que levem uma cópia ao Sr. Cigoli[29] o pintor, para que ele também tenha contato.

Beijo suas mãos, te reverencio e imploro para que me preserve em sua graça. De um desses senhores que ainda é lincei e que estava devendo uma resposta, mas eu escrevo

com vários transtornos e danos à saúde, peço desculpas e espero obtê-la.
Dalla Villa delle Selve, li 12 di Maggio 1612.

Considerações:

1. A melhora na saúde de Gallieo sempre trazia grandes esperança ao Príncipe Cesi, mesmo que, apesar da doença daquele não deixava de realizar suas observações e escrever suas conclusões.
2. Galileo tem o seu nome entre outros Linces no catálogo sobre as plantas indianas.
3. Era Cesi quem buscava recursos para imprimir os trabalhos de Galileo, inclusive este era um dos maiores interesses de Galileo em ser um linceo.
4. Neste período, as manchas solares eram vistas com telescópio sobre o disco do Sol, elas não são vistas muito distantes dele, mas são contiguas a ele, ou estão separadas por um intervalo tão pequeno que é imperceptível. Essas manchas não são estrelas e nem outro corpo sólido de longa duração, porque continuamente algumas são produzidas e outras se dissolvem, as de curta duração: 1, 2 ou até 3 dias; e as de maior duração: 10 à 15 dias e, outras podendo a chegar de 30 à 40 dias. Elas variam constantemente a sua forma, sua densidade e ainda podem ser separadas em 3 ou 4 novas manchas menores, ou ainda, se unirem para formar uma nova - essa última acontece próximo da circunferência do disco solar que está próximo do meio.
5. Galileo estava reunindo argumentos comprovados por meio de suas observações para ter sucesso com sua nova proposta de ciência.
6. Existiam grandes conflitos entre os seguidores de Aristóteles e Galileo, isso devido ao que cada grupo acreditava, enquanto Galileo e os outros lincei estavam buscando compreender a natureza do universo, os aristotélicos se preocupavam em manter a imutabilidade de um universo defendido por eles e pela Igreja Católica.
7. Com o desenvolvimento de um telescópio capaz de fazer observações mais distantes no sistema solar, Galileo conseguia cada dia mais provas para romper com os paradigmas vigentes.
8. Cigoli foi um grande pintor que viveu entre o período do Maneirismo e do Barroco. durante sua vida se ocupou da pintura, artes plásticas, anatomia pictórica, cenografia e música. Cigoli foi amigo pessoal de Galileo, e foi considerado por ele como o maior pintor da época. Fizeram um trabalho em conjunto, em que, pintou um afresco na cúpula da capela paulina da Igreja de Santa Maria Maggiore localizada em Roma, retratando a Madonna de pé sobre uma lua como vista ao telescópio, ou seja, uma lua *maculada* sob os pés de uma virgem (imaculada). Antes dessa imagem, a Lua da Virgem era sempre representada lisa, perfeitamente esférica, conforme descrito pela tradição aristotélica-tomista.

Final considerations

This work was a huge research challenge since it deals with two very important figures in the construction of modern science and who lived in a rich historical moment. The Renaissance was an explosion of art and ideas centered around artists, writers, scientists and thinkers, generating great transformations in the world. Knowledge was essentially inter and transdisciplinary.

During this period, human beings became the thirst for knowledge, freeing themselves from the shackles of oppressive religious power. Human understanding began to gain more value and science became fundamental in this process of understanding the world and its still unrevealed nature. It was a time of great struggle and many sacrifices, as can be attested by the censorship of Nicolaus Copernicus' book, the imprisonment of Tommaso Campanella, the execution of Giordano Bruno, and the condemnation of Galileo Galilei.

Returning to the research question of this work: *Which concepts contained in the letters exchanged between Prince Federico Cesi and Galileo Galilei during the Renaissance contributed to the process of constructing scientific knowledge?*

Theorists who portray this period were read, and through them, one can understand the intrinsic relationships between the various areas of science and society. There are many examples that involve a discussion on interdisciplinarity, in the West's incessant search for the construction of a new science, free from theocentrism.

A good example is the Accademia dei Lincei itself, with its founder, Prince Federico Cesi, and his partners: archaeologists, chemists, mathematicians, doctors, scholars, artists, astronomers, philosophers, architects, and poets. There were 32 chairs divided between men and women, who together constructed great theories and contributed to the development of society. Thus, one can perceive the complex relationships in the construction of this knowledge during the Renaissance.

The character Galileo, for example, could have contributed much more if he had not been condemned by the Catholic Church, preventing him from carrying out his research. Added to the difficulties of house arrest were his health problems, such as poor vision (he was almost blind), arthritis that had been getting worse since he was 30, irritation on his eyelids and high fevers, which also prevented him, at various times, from continuing his many projects.

However, he received help from several friends who contributed to his research, including artists, philosophers, doctors, thinkers, among others, showing that science is a collective construction, and not the discovery of a genius. Just as he was helped, Galileo also helped in the development of several works: one of them, by his friend Prince Cesi, as he developed catalogs and built botanical gardens, studying various regions, such as the plants of India, for example.

The meeting between the Roman aristocrat Prince Cesi and the Florentine scientist Galileo brought great advantages not only for the two, but for the entire society. They became friends as soon as they were introduced, initially due to the interests of both. Cesi needed Galileo's fame to raise the prestige of his Academy and Galileo wanted solid contacts in Rome, in addition to wanting help to edit and print his still incomplete books. Both were loyal friends, always overcoming religious and social problems, as well as those related to the science itself that was in development.

In this way, Galileo was a fundamental figure in the success of Science during the Renaissance, developing the first systematic studies of uniformly accelerated motion and the movement of the pendulum, and enunciating a still

erroneous principle of inertia, ideas that were precursors of the Mechanics that would be developed after his death: Newtonian Mechanics (NEWTON, 1990, 2008) [14, 15]! Galileo significantly improved the refracting telescope, and it was with it that he was able to observe sunspots, the mountains of the moon, the phases of Venus, the four satellites of Jupiter, the rings of Saturn (although he did not understand that structure due to the limitations of his optics) and the stars of the Milky Way. The new science proposed by Galileo contributed significantly to the defense of heliocentrism, one of the most contested theories at the time and whose idea, coming from the work *De Revolutionibus Orbium Coelestium*, by Johannes Kepler, was prohibited in the *Index Librorum Prohibitorum*. In this way, Galileo, with his bold ideas, his imprisonment and his intellectual boldness, broke the bonds of the Aristotelian-Thomist world, building modern science and achieving the marriage of the Physics of heaven and Earth, preparing the ground for Sir Isaac Newton's *Principia.*

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