SCIENTIFIC THINKING AND NARRATIVE DISCOURSE IN EARLY MODERN ITALY

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ABSTRACT OF THE DISSERTATION

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"Scientific Thinking and Narrative Discourse in Early Modern Italy" explores scientific texts and artifacts as cultural productions in the context of the Scientific Revolution. In the sixteenth and seventeenth centuries, scientific writing was a new emerging genre drawing on the Book of Nature metaphor refashioned by Galileo Galilei as an interpretive key to read and to write about nature in the Italian vernacular. This study examines scientific and humanistic traditions as a means of discovery and discussions associated with mathematics and experimental findings across treatises, poems, archival materials, and artworks.

This research is centered on four topics of early modern science that form the basis of the chapters: 1) the Book of Nature metaphor, from books and letters by Galileo to the readers and writers he inspired; 2) new scientific language and terminology, in prose and poems; 3) scientific data, instruments, and communication regarding applied technologies, and 4) medical humanities perspectives and texts on syphilis and plague.

This study advances a literary and historical understanding of scientific and technical literature by analyzing a variety of authors through the lens of genre, exploring the ways these writers presented rhetorical tropes and scientific research data so that they could update humanistic

modes of expression, communicate effectively, and establish scientific communities among professional and nonprofessional science enthusiasts. My research deals with issues of authorship, originality, and the question of an appropriate language, style, and communication for scientific contents, opening considerations on scientific thinking and narrative discourses as more than marginal, or an appropriation from non-literary domains, addressing global, technological, and social challenges faced by scientists and their readerships.

KEYWORDS:

Science; Italian; Galileo Galilei; Literary Analysis; Digital Humanities.

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Introduction.

In my Ph.D. dissertation "Scientific Thinking and Narrative Discourse in Early Modern Italy," I explore science as a cultural phenomenon connected to the origins and developments of scientific writing in Italy in the sixteenth and seventeenth centuries. The objects of this research are scientific narratives, in prose and poetry, and cultural productions such as books, illustrations, and letters discussing scientific thinking and narratives within the context of the Scientific Revolution in Italy.

Scientific narratives found in books and letters reveal more than scientific discoveries in mathematics, physics, astronomy, and medicine, as historical and social conditions between 1543 and the 1630s inform our experience as readers of those texts. Key figures are Galileo and his followers, but also scientists, humanists, and artists whose prose, poetry, and artworks represent scientific thinking in progress, as agreed, among others, by Giovanni Getto, William R. Shea, Andrea Battistini, and Ottavio Besomi. The timespan I selected coincides with the cultural context of the Scientific Revolution, as ascertained by historians of science Thomas Kuhn, Charles Singer, and Andrew Wear. My research benefits from literary and historical methods guiding my archival research, where knowledge of book history and digital humanities methods have assisted my inquiries on scientific thinking, metaphors, neologisms, and communicative styles. Not only research by scientists in the early modern period is conveyed through their printed words, but their scientific thinking can be traced back to editorial discussions. At the Accademia dei Lincei, for example, scholars discussed contents, images, and promotional campaigns with Galileo to circulate ideas, thus showing attention for books as cultural objects in light of the motto

established by the founder, Prince Cesi, that one should "attend to the smallest things to obtain the greatest results" (in Latin, "minima cura si maxima vis"). Since linguistic perspectives are connected to mathematical and scientific concepts in their planning, I examine scientific and humanistic traditions as a means of discovery and discussion associated with mathematics and experimental findings expressed across treatises, poems, archival sources, scientific instruments and objects, and artworks. Early modern narrative modes range from prose to poems. Thus, I analyze treatises, pedagogical texts, private and open letters, but also poems and lyrics exploring scientific and technological themes.

As I show through my research findings, scientific writing became a new emerging genre based on the Book of Nature metaphor that Galileo presented as a fundamental thinking tool. "Philosophy is written in this grand book, the universe, which stands continually open to our gaze," Galileo wrote, and he added that "the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed" (*Opere di Galileo Galilei*, ed. Antonio Favaro, 1890-1909, VI, 232; trans. Drake 238). The implications on genres, styles, and scientific categories of descriptions have been numerous, and I retrace them to show how impactful the Book of Nature metaphor was, starting with the statement that one could apply that metaphor both to read and write about nature in Italian. The value of metaphors might be underestimated in textual sources expressing non-literary contents, though. While today scientific writers often refer to the DNA structure as a helix, is that really what it looks like in nature? If we pause to consider the importance of metaphors in pedagogical contexts, we might be surprised to notice that cultural and visual mediations have, indeed, been constant

components of technical writing, as well as an element of philosophical reflections on the science of nature, and the nature of science.

This research benefits from access to methods, sources, and analysis across literary and historical disciplines, to inform and enrich the research of language, culture, and history in Italian studies. Digital repositories allowed me to track early modern books across the world, in public and private collections. Galileo's editorial success is clear from catalogs at the Internet Archive, World Cat, and the World Digital Library that document many extant books written, printed, and circulated by Galileo, not to mention books circulating illegally without regular printing authorizations. In terms of editorial and archeological evidence, a book now found at the Library of Congress can be intimately connected to manuscript notes housed at the Biblioteca Nazionale Centrale di Firenze, in which Galileo discussed the best titles, the clearest diagrams, or the most memorable ways to express his ideas. Furthermore, owning books was a social marker of prestige, and it still is so. Recently, journalists have followed the theft of books written by Galileo, and it was with joy and relief that they reported when those books were found. That story sparked interest for Galileo's books in Padua, where the books were directed to a local antiquarian store (Andrea Pistore, *Corriere del Veneto*, 17 June 2019), but also in the United Kingdom, where the books were first stolen (Mark Brown and Angela Giuffrida, *The Guardian,* 10 November 2020). Those modern connections between authors and books still exist, in contents and material culture, and Galileo's texts showcase the cultural environment of four centuries ago.

Comments and information that are now housed in archives, and maintained in digital cultural heritage, might look marginal at first, as they appear on scraps of paper, at

the edge of printed pages or the back of envelopes, but no material culture has a hierarchical system of meaning. Therefore, material epistemologies intersect cultures and languages, as much as disciplines. A fundamental textbook on anatomy, *De humani corporis fabrica* by Vesalius (1543), for example, was annotated by Philip Melanchthon in the flyleaf of his personal copy where he wrote his observations on the human body. In that book, now at the National Library of Medicine collections in Bethesda, I could read Melanchthon's poem in Latin where, at the opening of the anatomical treatise by Vesalius, the Lutheran reformer addressed himself or those who could hold his book, to "Think not that atoms, rushing in a senseless, hurried flight / Produced without a guiding will this world of novel form" (Lines 1-2). He suggested that characters must be found, when we study nature, "[…] nor are the traces far to seek, so bright and clear they stand" (Line 5). The work of discovery starts with mathematics, Melanchthon insisted, "[…] to know the ways of numbers and their order" (Line 7), so that one could also understand "[…] the disposition of the Earth, eternal with the skies, / The ordered movements of the stars recurring in their course" (Lines 11-12) and "[…] the [human] body's several parts" (Line 15).[1] What we find in early modern books on science are, thus, narratives that bring to us, modern readers, storytelling processes on science as the legitimate study of nature, in a long tradition of the Book of Nature metaphor that Galileo adapted to new experimental contexts.

This study is centered on four topics of early modern science that form the basis of my chapters: the Book of Nature metaphor, scientific language, scientific data, and medical humanities. In particular, I argue that the Book of Nature metaphor refashioned by Galileo

[1] The poem, written in Nuremberg, is dated 25 January 1552. It was published and translated by Dorothy M. Schullian ("Old Volumes Shake Their Vellum Heads." *Bulletin of the Medical Library Association*, volume 33, No. 4, October, 1945: 413-48; 440).

became an interpretive key for reading about nature as well as writing about it. Such metaphor became very popular in a book by Galileo Galilei, *Il saggiatore* (*The Assayer*), published in 1623. Chapter One, "Reading the Metaphor of the Book of Nature," uses the framework of the Book of Nature to trace a relationship between the books by Galileo and the authors he inspired. Starting from books on physics and astronomy by Galileo, up to the Baroque narrative and poetry of Marino's *Adone* and also contemporary authors' poems on medical topics, I draw parallels between expert and non-expert appropriations of scientific contents in the circulation of new ideas. My research in that section deals with issues of authorship and originality as concurrent with the question of the appropriate language, style, and communication for scientific contents.

In Chapter Two, "Seeing through Metaphors: Humanistic Words for Scientific Ideas," I compare innovations inspired by the Book of Nature metaphor to integrate the work of established and emerging scholars who were interested in science as a narration of natural phenomena in the sixteenth and seventeenth centuries in Italy. Scientists conveyed their experiences and perspectives through treatises and textbooks addressing specialists in cultural establishments, but also through popularized versions appealing to readers approaching the study of nature, when poets communicated some of those important innovations in lyrical forms.

Chapter Three, "Data Persuasion: Quantification and Authority in Scientific Writing," considers new contents such as numbers, scientific instruments and communicative modes of correspondence and cryptography in early modern scientific communication. From textual premises previously analyzed, such scientific revolution shows to be based both on texts and on cultural ideas, particularly in Italy, where lexical

innovations were introduced by Santorio Santorio, for example, when he integrated classical readings of Hippocrates and Epicurus with numbers, quantities, and observations based on scales.

Chapter Four, "Complementing Medical Narratives and Narrative Medicine," analyzes medical humanities texts describing early modern epidemics, namely syphilis and plague, from the perspective of physicians and patients. While Girolamo Fracastoro embraced humanistic conventions to coin the word for syphilis in a pedagogical poem in Latin, other physicians explored the knowledge gap between science and its communication to integrate scientific and humanistic discussions, and to include insights on how patients perceived their own conditions.

This study examines the relation between scientific writing and thinking by analyzing how early modern scientists used experiments in language through narrative forms to express scientific experiments and observations in mathematics, physics, astronomy, and medicine. Through literary and scientific reflections, contents such as natural experiences and experiments were conveyed to a readership, either learned or nonprofessional, to be clear, memorable, and precise scientific communication. By writing in Italian, those scholars intended to encourage new ways of thinking and talking about nature through new words and styles, while fostering scientific communication on a larger scale, as Galileo did in his fable on the origin of sounds in *The Assayer*. If the origin of sounds is a fable that does not suggest one sole answer, Italian readers and scientific authors found Galileo's example to inspire prose and narrative forms in Italian that express plurality, so that the words of what is possible, and what is real can build textual and scientific persuasion alike. While scholars traditionally interpreted the Book of Nature

metaphor as a rhetorical trope and acknowledgement of medieval sources, this research shows medieval cultural heritage to be only a starting point for more than rhetorical innovations.

In addition to stylistic aspects, I also examine the relation between scientific writing and thinking by analyzing scientific terminology regarding natural experiences and experiments. Concurrent words and cultures provided a working vocabulary, then cultural rules granted validity and authority to texts and authors, so that the Italian language reached some form of standardization through practice and the dictionary of the Accademia della Crusca. Early modern cultural discussions and the so-called 'debate on language' as articulated by Pietro Bembo and other humanists influenced lexical preferences, and Galileo's books were considered to be an example of prose to include in entries for scientific neologisms in the Accademia della Crusca dictionary. Thus, a scientific discourse could be humanistic, narrative, and factual either in Latin, the official language for academic and international communication, or less traditionally in the Italian vernacular then spoken in cultural establishments such as universities and academies. Intellectuals who discussed science in their works chose to express new scientific ideas, current debates in science and its communication, and the process of thinking and elaborating scientific data through available humanistic tools such as languages, narrative modes, and styles of communication.

Chapter One. "Reading the Metaphor of the Book of Nature."

1. Opening Themes.

In scientific disciplines, from mathematics to astronomy, early modern readers and scientists could often hear and read praises and insights into the 'Book of Nature.' In Italy, such expression became a metaphor in a book, *Il saggiatore* (*The Assayer*), that Galileo Galilei published in the Italian vernacular in 1623. In his words:

> La filosofia è scritta in questo grandissimo libro che continuamente ci sta aperto innanzi a gli occhi (io dico l'universo), ma non si può intendere se prima non s'impara a intender la lingua, e conoscer i caratteri, ne' quali è scritto. Egli è scritto in lingua matematica, e i caratteri son triangoli, cerchi, ed altre figure geometriche, senza i quali mezi è impossibile a intenderne umanamente parola; senza questi è un aggirarsi vanamente per un oscuro laberinto (Galileo, *Il Saggiatore* in Favaro, ed. *OG* VI, 232).[2]

Galileo articulated the Book of Nature as a metaphor composed of several layers of meaning ranging from the physical world to the human experience of languages, mathematics, and geometry as the keys to deciphering the book, that is nature itself. The language Galileo had chosen for the passage quoted above, in *The Assayer*, is the Italian vernacular – the language that Dante had inspired with much of its vocabulary, and that Bembo delineated in its cultural identity through medieval, authorial sources: Dante, Petrarca, and Boccaccio.[3] The contents of Galileo's book, though, were not literary as the

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[2] "Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it. Without these, one wanders about in a dark labyrinth" (*Opere di Galileo Galilei*, 1890-1909, VI, 232; trans. Drake 238). From now on, I will refer to the collected works by Galileo edited by Favaro as *OG*. The translation quoted above is by Stillman Drake, a historian of science who translated *The Assayer* and interpreted its cultural implications.

[3] Pietro Bembo, *Prose della volgar lingua*. Venice: Andrea Arrivabene, 1525.

texts upon which Italian was mostly based, because *The Assayer* is a book discussing science, in particular comets. Galileo's choice of the Italian vernacular was, thus, unconventional for several reasons. To start, Galileo's book was in response to the treatise that Father Orazio Grassi had written in Latin, and debates between Galileo and Grassi were mismatched, in that sense, across two languages, regardless of occasional passages in which Galileo quoted directly in Latin from Grassi's book, or from texts cited. Furthermore, the vernacular helped to popularize contents that had traditionally been expressed in Latin treatises for specialized readerships, thus giving wider access to a topic such as astronomical phenomena. In the new linguistic medium, however, there were no pre-determined features, yet, in terms of styles, forms, and contents for the new role of the Italian vernacular in scientific communication.

In Galileo's lifetime (1564-1642), the genre of scientific writing was young, compared to the long history of writing in academic Latin, which at that time coexisted with recent translations into local vernaculars throughout Europe for some popular medical texts. The book by Galileo, *The Assayer*, was the first influential text in science that addressed a wider readership through deliberate linguistic choices in the current Italian vernacular, and its author was able to control written communication, while acting as a researcher and public scholar in his study of nature. As the designer of a new scientific narrative aiming for a wide readership, Galileo opened conversations to those who can read the philosophy of nature in the book that nature itself is. Since the Book of Nature represented a new type of knowledge, and new methods to pursue it, a new type of writing also ensued. Thus, through captivating stylistic expressions and the deliberate use of rhetoric in persuasive passages, Galileo introduced scientific concepts and, at the same

time, a new type of language, style, and genre. For example, he conveyed scientific ideas and experiences related to scientific discoveries through metaphors, similes, and a fable on the origin of sounds, all of which were incorporated into prose in order to reach specific communicative goals. From such perspectives, the Book of Nature metaphor allowed Galileo to keep continuity with humanistic practices, while also setting up a new style that became the standard one for scientific writing. Metaphors and storytelling practices would belong to humanistic domains, but also to scientific communication that is clear and effective, too. Most scientists received an extensive humanistic education prior to embarking on more technical subjects, as documented by university roster records collected by Tomasini and Wear. Scientific contents interconnected to literary ones in Latin, too, when Johannes Kepler wrote his book *Somnium* (*A Dream*), in which an Icelander travels to the Moon and explores it, to find what is different, or like life on Earth. Kepler used the theme of traveling in outer space to describe the Moon, but also to mention the problem of witchcraft, through which he might have alluded to the accusations and trial against his mother Katharina. That text, though, was only published posthumously by his son Ludwig, so the astronomer's intentions are not fully clear regarding the book that is considered the first scientific fiction. While scientific contents are expected in scientific books, the use, repetition, and validation of rhetorical modes and styles made science open to more literary traditions in Italian.

2. Texts and Contexts for Radical Metaphors.

The present study of scientific genre conventions considers material book history as fundamental to understanding authorial intentions, editorial revisions, and printing practices as interconnected cultural processes. Delineating narrative features is a theoretical component of Structuralism that Propp's *Morphology of the Folktale*, for example, proposed as narrative categories in terms of characters, situations, and plot developments. Here, however, I do not derive elements in my rhetorical analysis directly from Propp's publications, drawing instead on his methods to inspire the following considerations and examine a very different type of writing, the one discussing scientific themes. In scientific communication, a rhetorical treatment of topics had been unusual, since it was not customary for scientists to devote attention and to aim for accessible language as well as refined literary expressions in light of their prospective readerships. Scientists were, however, part of a scholarly community in which newly published books and private correspondence alike fostered discussions of ideas and natural experiences, which they started incorporating into their books.

Given that nature can be discussed in books, each scientist had a role in the study of nature and the circulation of those findings. Scientists writing books, furthermore, had a duty to be clear and persuasive, and Galileo's use of the Book of Nature metaphor will be central to the present study on scientific writing through the analysis of scientific texts in Italian in between 1543 and 1632. The start date, that is the year 1543, became a marking point in the history of scientific literature, so that modern scholars refer to that time and cultural environment as the Scientific Revolution, especially after debates in historiography started by historian of science Thomas Kuhn. Starting in 1543, views on

astronomy and human anatomy were innovated by some authors whose books challenged earlier, established traditions of scientific and medical thought. In that year, Nicolaus Copernicus published an astronomical treatise in Nuremberg, titled *De revolutionibus orbium coelestium* (*The Revolutions of the Celestial Bodies*), and Andreas Vesalius published an anatomical atlas in Basel, *De humani corporis fabrica* (*The Structure of Human Bodies*). Both books were written and published in Latin, the official language for academic international communication. Because of the timely coincidence of such two influential texts in science published in the same year, 1543, scholars consider that year to be the turning point for the early modern Scientific Revolution.

The end date for the timeline I trace for this research coincides with the publication of Galileo's *Dialogo sopra i due massimi sistemi del mondo* (*Dialogue on the Two Chief World Systems*) in 1632, soon to be forbidden and banned that year in the Index of Forbidden Books (*Index Librorum Prohibitorum*). The *Dialogo* started the Inquisition trial in which Galileo was accused of heresy, leading him to recant his astronomical theories on heliocentrism the following year, in June 1633. Thus, the *Dialogue* stands for one of the last venues for free expression on scientific topics in astronomy in seventeenth-century Italy and, more broadly, in Catholic Europe.[4] By setting temporal boundaries, I can consider scientific texts that were published under regular printing permissions at a time when discussions of all topics in astronomy was still appropriate, before the 1633

[4] Father Benedetto Castelli had heard rumors according to which Pope Urban VIII (formerly, Cardinal Maffeo Barberini) had informed Tommaso Campanella that he would not have banned Copernican theories, if the matter had depended on him (16 March 1630; *OG* XIV, 87-88). That discussion occurred when some would-be converts from Protestant countries seemed upset to hear that Copernicus's texts had been banned. Later, however, Filippo Magalotti informed Piero Dini that the Pope was upset to read Simplicio repeat, at the end of the *Dialogo*, what Barberini had suggested to Galileo in a private conversation, namely that God has many ways to create and regulate nature ("I Giesuiti lo perseguiteranno acerbissimamente... non si può negare che la S.tà di N. S.re non sia d'oppinione assolutamente contraria" *OG*, XIV, 370, and 379-80).

Inquisition trial and regulations prohibiting any books discussing Copernican views of the universe. The *Dialogue* generated lively European discussions soon, thanks to its Latin translation as *Systema cosmicum* by philologist Matthias Bernegger (1635), in a version that proved influential to circulate ideas that Galileo had published in Italian in a very specific situation such as a conversation spanning over four days, in Venice, among three characters discussing nature and science.[5]

In this chapter, I will show how the Book of Nature metaphor was instrumental in Galileo's books to reorganize and structure scientific arguments in a new language. In particular, two rhetorical highlights of Galileo's *Assayer* are the Book of Nature metaphor (*OG* VI, 232) and the so-called fable or apologue on sounds (*OG* VI, 279-81). In more recent times, Primo Levi and Italo Calvino acknowledged how important Galileo was for his contributions to scientific communication and great literature up to the twentieth century.[6] The Scientific Revolution was both textual and cultural, particularly in Italy, where lexical innovations came from scientists themselves. They introduced new ideas

[5] A copy of that translation is housed at Rutgers University Special Collections and University Archives. Bernegger had also discussed the resistance of new conversions to Catholicism of former Protestant German scholars, who found it difficult to accept the post-1616 restrictions on Copernican explanations of the universe merely as hypotheses. Problems of compatibility between heliocentrism and Catholic doctrines ignited discussions with Jesuit scholars and other opponents to Galileo's radical ideas. On the circulation of the printed *Dialogo*, see a letter by Magalotti ("non potendo darsi sodisfazione nel libro dei *Dialoghi*, perchè [sic] di già n'erano usciti fuori e sparsi troppi per tutt'Europa; perchè questo arebbe dato grandissimo fastidio, apprendendosi, per quanto io veggo e anco non ho lasciato di far credere con buona occasione, che pochi se ne sieno spacciati, mediante l'esser serrati i passi, rispetto al contagio" *OG* XIV, 379-80). Magalotti had tried to show the Pope that there was no malice and that, instead, Salviati's lines had shown the due respect for a Biblical passage from the book of *Job* that had important theological implications regarding celestial motions. I am following orthographic and typographical conventions from Favaro's edition in terms of accents and spellings throughout this research.

[6] For Levi's appreciation of Galileo, see Mario Porro, "Primo Levi e Galileo Galilei" in *Innesti. Primo Levi e i libri altrui*. Ed. Gianluca Cinelli and Robert S. C. Gordon, Oxford, Peter Lang, 2020: 37-54. I have explored cultural connections from classical antiquity to Levi and Calvino in an article, "Communicating across Cultures: The Case of Primo Levi, Italo Calvino, and Pliny the Elder" in *Translation and Globalization across Classrooms, Communities, and the Humanities*. Ed. Concepción Godev. New York: Palgrave Macmillan Publishing, 2018: 63-77, which has been included in the Institute for the Study of Human Rights (ISHR) at Columbia University, in the Memory Studies bibliography.

both through new words, as neologisms carefully pondered from prestigious languages such as classical Greek and Latin, and through words already present in the Italian vernacular that they repurposed for scientific communication. Furthermore, authors discussed Italian words and style in strategic book structures such as prefaces, and they circulated letters discussing cultural values in science that, in turn, corresponded to humanistic conventions in literature.[7]

The presence of a Scientific Revolution has long been debated in studies of European history and culture.[8] According to historian of science Kuhn on "scientific revolution(s)", changes in thinking patterns produced new scientific models that he called "paradigms." The reframing of thinking modes and patterns is, however, a topic of inquiry that has occupied scholars in the last fifty years, leading some to oppose the use of the phrase 'Scientific Revolution' as a conventional setting of chronological boundaries that would not be conducive to historical studies. All paradigms, Kuhn argued, are time-specific and enable cultural transitions. In this research, keeping a specific timeline for primary sources allows me to prove the relevance of cultural investigations in the study of nature, and to retrace the influence of the Book of Nature metaphor in Italian texts published in the early modern period. While a variety of scientific disciplines will be included in this study, it would, however, be reductive to look at early modern science in Italy as a list of scientific, technological, and medical accomplishments. Accordingly, it would also be counterfactual to express any form of judgement based on the accuracy and validity of

[7] My selection of the timeline from 1543 to 1632 follows a manifest cultural and linguistic change in the discussion of scientific topics. Categories such as "modern" or "advanced" do a disservice to cultural studies of the sixteenth and seventeenth centuries.

[8] For another reading of the Scientific Revolution as a personal endeavor of Galileo, see William R. Shea, *Galileo's Intellectual Revolution: Middle Period, 1610-1632*. New York: Neale Watson Academic, 1972.

results and discoveries.[9] For example, Galileo found older astronomical explanations deriving from Ptolemy's texts to be no longer functional as they failed to match astronomical phenomena, so that scientists would be at a loss at describing and interpreting the motions of Mercury and Venus, in particular. On the contrary, Nicolaus Copernicus had published working hypotheses that explained apparent anomalies in a book in Latin, and Galileo introduced Copernican ideas into scientific literature and made them accessible to those who could read the Italian vernacular through textual and visual hints, to popularize some astronomical and physical concepts.

That shift from Ptolemaic to Copernican explanations reversed scientific theories on the universe, but also the importance of the Earth and the relevance of its human inhabitants in celestial and religious themes expressed in the Holy Scriptures. Because of such vicinity with theological ideas, the Book of Nature was not immune from controversies, both scientific and theological, which impacted Galileo as the author of the metaphor that seemed to call for comparisons, or so it was claimed by Galileo's opponents, between two systems of truth. To start, science and its methods to investigate nature appeared independently from theology, Galileo argued. He had heard Cardinal Baronius say that the "intention of the Holy Spirit is to teach us how to go to heaven, not how heaven works," and Galileo made that argument his, in a letter he wrote to the Grand Duchess Christina of Lorraine in 1615.[10] While theological books can help readers to understand

[9] Positivistic studies were also consulted for this research, with the goal of contextualizing the study of the Scientific Revolution in the Italian intellectual and cultural history. The question was initially raised by Ludovico A. Muratori (*Scritti inediti di Ludovico Ant. Muratori pubblicati a celebrare il secondo centenario dalla nascita di lui*. Bologna: Zanichelli. 1872: 100-102).
[10] *OG* V, 307-48.

nature as a divine creation, scientific texts intend to circulate science and make it widely accessible and popular as nature is the primary theme discussed.

Taking an approach that was not merely historiographic, and refusing general conventions in dates, Kuhn considered it important to understand when science was being questioned in its methods under several aspects that eventually "created an increasing crisis for existing theories of motion" and "ultimately produced a crisis for the paradigm from which it had sprung" (Kuhn 74). The implications of this new paradigm were scientific, but also cultural. Why using the term 'revolution,' though, which is often used in political contexts today? Or, as Kuhn asked, "[…] why should a change of paradigm be called a revolution? In the face of the vast and essential differences between political and scientific development, what parallelism can justify the metaphor that finds revolutions in both?" (Kuhn 92). What is common between political and scientific 'revolutions' is the mutation of standards, which resembles those political disruptions that subverted societies, bringing new regimes and laws. The word 'revolution' appeared also in the title of the book by Copernicus, meaning circular planetary motions that start and end in the same point, so that those are 'revolutions' because the celestial bodies revolve and return to the same point where the motion had first started.[11]

Rhetorical and stylistic features were open to innovations, within established literary traditions in the Baroque. In literary domains, the use of rhetorical modes had a solid tradition in a variety of contexts, social situations, and academic disciplines. In the seventeenth century, those theories were summarized by Emanuele Tesauro in his 1654

[11] The Latin word "revolutio" is a combination of the iterative prefix "re-" and the verb "volvo." Looking at cultural understandings of science before and after Galileo, Kuhn found the early modern Scientific Revolution to be comparable, in its effects and consequences, to any major change in accepted models of nature, including James C. Maxwell's theories on electricity and magnetism in the nineteenth century.

handbook of rhetoric, *Il cannocchiale aristotelico* (*The Aristotelian Spyglass*).[12] An underrepresented topic in Italian studies has been the development of fundamental Italian texts in the scientific community and, within those texts, the fundamental moments in scientific communication and persuasion. This chapter, thus, challenges received traditions on continuity and breaking points in scientific knowledge, as well as a compartmentalization of knowledge into humanistic and scientific domains. Though post-Tridentine deliberations affected a reader's ability to access religious and non-religious texts alike, Galileo enabled the discussion of non-literary topics, but also the expansion of literary themes such as style and linguistic possibilities, in the literary modes and rhetorical tropes of Baroque experimentations, thanks to which he promoted a shift in beliefs on nature through the Book of Nature metaphor in *The Assayer*.

The Assayer was written as a letter to the Roman intellectual and poet Virginio Cesarini, a member of the 'Accademia dei Lincei' and a chamberlain to Popes Gregory XV and Urban VIII.[13] Cesarini was a refined humanist and the author of poems in Italian and Latin (*Poesie liriche toscane e latine*. *Carmina*, 1669).[14] In May 1622, he persuaded Galileo to write a letter to publish in response to Grassi's 1619 attacks. As was customary for the time, a printing permit ('imprimatur') was required for the book, which Dominican

[12] *Il cannocchiale aristotelico*. Venice: Paolo Baglioni, 1664. The publisher, Paolo Baglioni, was the son of Tommaso, the publisher of *Sidereus Nuncius* by Galileo (1610), which shows how printers were ready to publish scientific books with a new perspective on nature, partly because of their mindsets and partly because there was a market with readers willing to buy those new texts, though market prices still were not cheap for mass distribution.

[13] "[…] lettera all'illustrissimo e reverendissimo sig. don Virginio Cesarini accademico Linceo, mastro di camera di N.S."

[14] An oil portrait by Anthony Van Dyck (1623-1624? Hermitage Museum, Saint Petersburg) shows Cesarini in ecclesiastical robes, looking pale and melancholic. A bust of Virginio Cesarini, allegedly by Francois Du Quesnoy, is attributed to Bernini (Palazzo dei Conservatori at the Musei Capitolini; Catalogo Fondazione Zeri, Bologna).

father Niccolò Riccardi gave after revising the text.[15] The genre of a letter, though fictional, is suitable to convey a personal, relatable experience to readers. Indeed, discussing science in a letter could show arguments and the flow of ideas, as a dialogue in person would. Furthermore, the form of the letter gave Galileo the opportunity to address counterarguments that could likely arise in discussions between opponents, had they been able to meet in person. By building logical arguments, proofs and evidence, Galileo also preserved his authorial and scientific dignity because he could not destroy and humiliate a scientific opponent too directly. In *The Assayer*, addressing a friend such as Virginio Cesarini served, thus, the fictional purpose of keeping Galileo at a distance from the real recipient of those observations, that is, the scientist Grassi whose views Galileo criticized, while also connecting Galileo to the widest readership possible and maintaining their interest alive.[16]

Furthermore, talking about astronomy to his friend Cesarini made the topic of comets, air, and elements seem more appealing to non-specialists, too, as the familiar tone and point-by-point arguments were particularly powerful in persuading readers. The letter, indeed, prefigures the basic structure of the dialogue, while helping and testing what authentic conversations could sound like, when two or more people discuss research topics in a fictional written text. While several stylistic studies have concentrated on how approachable the genre of the dialogue is, and the *Dialogo sopra i due massimi sistemi del mondo* in particular, little attention has been paid to the scientific letter as a preparatory work towards the dialogue, and as a form of intermediate genre between a factual narration

[15] In Latin, a printing permit was called 'imprimatur' ("let it be printed"). That practice that was necessary after the Sant'Uffizio was founded by Pope Paul III in 1542.
[16] Gabriella Del Lungo Camiciotti has shown an antecedent to Galileo's dialogic form, in "Letters and Letter Writing in Early Modern Culture: An Introduction." *Journal of Early Modern Studies*, n. 3 (2014): 17-35.

and a fictional staging of facts, arguments, and conclusions through characters that debate their opinions. The use of the Italian vernacular and the type of comfort one can find in talking to a friend could keep that conversation, however scientific, spontaneous, and convey ideas and contents in the most straightforward way. Galileo's book could, then, become an accessible source of information and scientific culture at large, making his author respected and authoritative in the field of science and literature, too.[17]

Comets attracted astronomers but also curious readers, humanists, and intellectuals who were interested in comets because of historical comet apparitions and a rich tradition in classical texts describing natural observations, portents, and premonitions of future events associated to comets. Conversations among readers, enthusiasts, and opponents of *The Assayer* were frequent, and most comments were those of men, who had easier access to education and books at that time, with the notable exceptions of one educated woman, Margherita Sarrocchi.[18] Virginio Cesarini had urged Galileo to enter the debate on comets and write about it in a letter, and Galileo had answered with an open letter to everyone interested in the debate on comets, which in turn prompted many to write letters and connect with Galileo on scientific topics more broadly.

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[17] The letter was, to a literate world before audiovisual technologies, what the video format is to an image-based world like the one we are used to, today. Both the letter and the video format, in their immediacy, address and cover fundamental cognitive needs applicable to learning and research. For a reader, being the witness of a (written) scientific conversation can lower the affective filter, as does the theater experience of something we see represented on stage, when we might laugh or cry as the plot unfolds through characters' dialogues and monologues, while we are also aware that the plot is fictional, as the invention of human minds. In addition to this emotional filter removed, more current terms in the vernacular, more rhetorical tropes, a closer resemblance to humanistic narration, and less jargon would promote an ease of communication.

[18] See Enrique García Santo-Tomás, *The Refracted Muse. Literature and Optics in Early Modern Spain*, trans. Vincent Barletta. Chicago: University of Chicago Press, 2017: 37; see also Meredith K. Ray, *Margherita Sarrocchi's Letters to Galileo: Astronomy, Astrology, and Poetics in Seventeenth-Century Italy*. London and New York: Palgrave Macmillan, 2016.

The astronomical dispute on comets started in 1618 and generated extraordinary interest among scholars. Four main books were published to express Galileo's and Grassi's opinions, respectively. Historian of science Stillman Drake argued that those texts impacted the origins of modern scientific method with a controversy that was both scientific and philosophical, and he added that such historical circumstances inspired Galileo to design the scientific method.[19] The dispute had started with lectures by Jesuit Father Orazio Grassi that he published in 1618 (*De Tribus Cometis Anni MDCXVIII*). Later that year, Mario Guiducci, one of Galileo's students, published *Discorso delle comete* (*Discourse on Comets*). Grassi and others were certain, though, that the book was Galileo's work, a position that William R. Shea has confirmed after examining handwriting and marginalia in the original manuscript, and references to the early printed version.

Next, Father Grassi wrote a Latin essay, the *Libra astronomica ac philosophica* (*The Astronomical and Philosophical Scales*) under the pen name of Lotharius Sarsi that was an approximate anagram of his name in Latin (Horatius Grassi). Galileo responded to Sarsi's arguments in *The Assayer* that he published in 1623. Finally, in response, Grassi wrote a counter-polemic essay titled *Ratio ponderum librae et simbellae* (*A Reckoning of Weights for the Balance and the Small Scales*. Naples: Matthaeus Nuccius, 1627).[20] The *Ratio ponderum* by Grassi was the final book in that long series of books documenting the controversy on the comets, one of the most productive polemics in the early modern history of science. When, at the end of 1626, Galileo learned that Grassi had printed his

[19] See Stillman Drake, *The Controversy on the Comets of 1618*. Philadelphia: University of Pennsylvania Press, 1960.

[20] In the Naples edition, errors and omissions were corrected from "the mangled Paris edition" (Feingold 152) published in the previous year. It has been suggested that Grassi might have written the *Ratio ponderum* in collaboration with Christoph Scheiner, who had been involved in a separate controversy with Galileo in 1613, regarding the priority for the discovery of sunspots.

counterattack, he purchased a copy of Sarsi's book and annotated it with personal observations verging on frustration in the page margins. The conflict between Galileo and the Jesuits might have originated in the public dispute about comets that occurred between 1618 and 1626. In the long title for *Ratio ponderum* (1626), Grassi alias Sarsi mocked Galileo as a "simbellator," that is, someone using a "simbella," a scale used to weigh single coins. That word may also carry a pun on "cimbellare" and its variant "zimbellare" that means falling on the ground loudly, but also "to decoy" and "to mislead."[21] Grassi dismissed the role of the assayer, a fine measurer of precious metals.[22] In a sarcastic comment, Sarsi refused to see scales and precision in Galileo's *Assayer*. Galileo's prompt response was a letter, in which he discussed words, meanings, and the origins of those words to bring clarity, order, and gain respect from his opponent Grassi:

> Se voi aveste cognizione della lingua toscana, aresti, senza più oltre leggere nel mio libro, inteso come il nome *saggiatore* senza traslazione significa l'istesso che *collibista*, e non quello che *praegustator vini*, il quale noi chiameremmo *assaggiatore*, poi [che] si dice *assaggiare* il vino, e non *saggiare*. In oltre, già che voi dite che, avvertito del significato in che io lo prendo, comprendeste che il pigliarlo per *assaggiator di vini* era non pur falso, ma indecen[te] e poco sobrio, perchè scriverlo? non si può, per mio parere, dir altro, se non per darmi, con ricoperta assai [tra]sparente, titolo di briaco, con assai poca modestia (*OG* VI, 381).[23]

[21] *Tesoro della Lingua Italiana delle Origin*i and Tommaseo-Bellini.

[22] See Michiel de Vaan, *Etymological Dictionary of Latin and the Other Italic Languages*. Leiden-Boston: Brill, 2008, 339. 553. Under "libra", pound, measure of weight, and under the prefix "semi-", half "a coin worth half a libella".

[23] "If you were an expert in the Tuscan vernacular, regardless of how far you read my book, you would have understood how the name 'assayer' means the same as 'measurer' without metaphorical means, and not drinker or wine-taster, since we say 'tasting' wine, not 'weighing' it. Furthermore, if you said you understood my explanation, then why do you call me a wine-taster, falsely, indecently, and not in a sober way at all? I cannot say anything else: you want to call me drunk, with very little modesty" (translation mine).

Sarsi also claimed that "saggiatore" really meant "winetaster" ("assaggiatore"), which explained why the book would be published in the Fall, when new wine was available.[24] To bring a scientific, linguistic, and intellectual revolution into early modern Italian literature, Galileo had designed a metaphor whose value increased with its circulation, even when debates surrounding it brough personal attacks against himself. A Book of Nature metaphor was branded as Galileo's new and personal byword that will connect to Baroque mottos and emblems in textual and visual forms.

Though Galileo considered writing a response in 1628, Prince Cesi and other intellectuals in Rome persuaded him that it was not worth answering. The controversy on comets, then, ended (Drake, *Galileo at Work* 304-09). Galileo's book in that dispute, then, was only one, at least officially. It quickly sold out, as one can guess from the high number of surviving copies in modern-day libraries. Given the number of letters discussing *The Assayer*, it is reasonable to imagine a wide readership in the first two generations after the book was published.[25] Competition for Galileo's books was intense for bookstores seeking to gain access to the new scientific cultural market and to profit from high-demand sales. Therefore, sellers needed to get new copies quickly to respond to the increasing demand for the new book by Galileo, in an editorial success that was extraordinary, perhaps surpassing the *Starry Messenger* for which only a few copies had been first published in March 1610.

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[24] See Drake viii; xx. The two possible meanings for the word "saggiatore" are also alluded to in Prince Federico Cesi's letter to Angelo De Filiis, sent from Acquasparta on 7 February 1623: "Quando assaggiarà ciascuno il *saggiatore*, e quando i saggi n'haveranno quel tanto aspettato e desiato saggio?"

[25] The estimate for the number of over fifty extant copies of the *Assayer* relies on the world libraries website www.worldcat.org which presents itself as "the world's largest network of library content and services." Accessed 4 October 2019.

When *The Assayer* was about to be printed, Francesco Stelluti referred to the book through the scientific instrument named "scandaglio," the nautical sounder, which in that context is both a metonymy for the book itself, and the prospective design of an emblem the academicians would like to have for Galileo's book on the frontispiece (12 August 1623, *OG* XIII, 121-22). In a letter, Stelluti mentioned to Galileo that his friends and editorial helpers had plans for an illustration that should match the theme of the assayer as one who weighs precious materials with great precision. Along with a request for help from Galileo, Stelluti implied that working with the printer and craftsman was necessary to get the block ready for printing, but it was also important to complement the meaning and purpose of the text in visual forms, through a calculated display of the knowledge of nature, in *The Assayer*.

The frontispiece chosen for the book shows two women standing by the sides of the title itself, who are personifications of the values they represent: natural philosophy and mathematics, respectively. Natural Philosophy holds a book and astrolabe, whereas Mathematics has an armillary sphere and ruler in her hands. Visually, the illustration reveals the importance of the two disciplines as methods, as readers and viewers can gather from the proximity of figures, denominations, and instruments associated next to the book title. The stories one tells about science can reveal a process of discovery, celebrate successes and accomplishments through scientific results and discoveries, and show the role of readers and editors from the Accademia dei Lincei, which I will follow in the following sections.

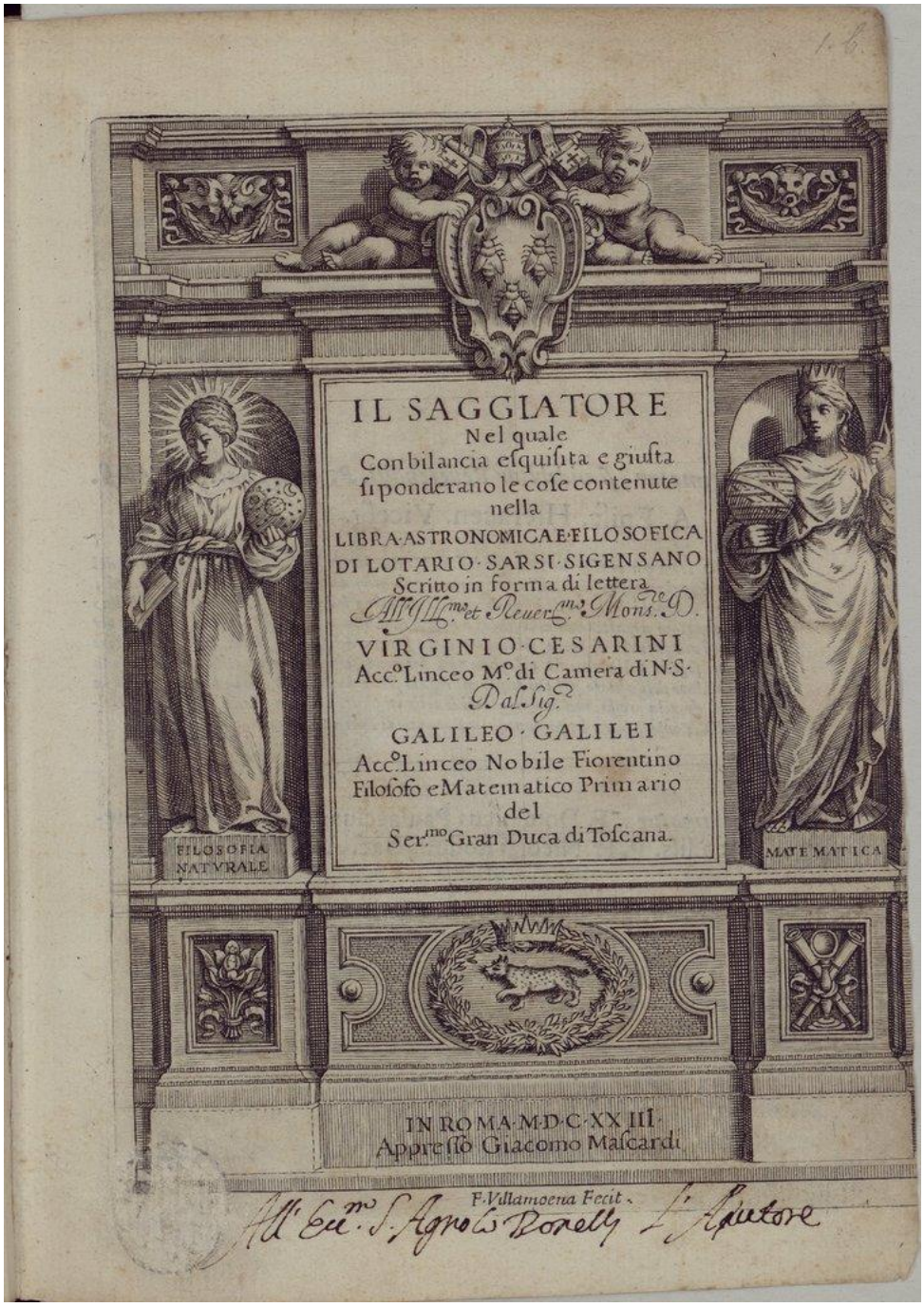

Figure 1. Galileo Galilei, *Il Saggiatore* (Roma: Mascardi, 1623).
Courtesy of the World Digital Library. Picture in the public domain.

In the scientific narrative and textual process, scientific writing benefitted from textual strategies such as rhetorical tropes that were traditionally part of humanistic practices. By referring to personal experiences as well as relatable, accessible metaphors and fables, readers would be able to follow arguments in the contexts that authors had crafted for them. Persuasion lay in corroborating individual beliefs proven to be correct not through quotations from respected classical texts, but through scientific observations and methods. Though prose was the preferred form to write about science, poems were written on science, too. In lyric, epic, and didactic tones, poets pitched scientific novelties and reflections on science for the general audience, which I will discuss in the following chapter.

Science had become such a popular topic to discuss, both in prose and poetry, and the introduction of the Book of Nature metaphor affected the appreciation of science in Italy. Another medium of communication is found in Galileo's private correspondence, as it is surviving in letters that Antonio Favaro collected and edited in Galileo's national edition (*OG* volumes X to XVIII). Those letters refer to passages in printed books and to other letters, but also to conversations, and material culture details in everyday life that we could not capture and study otherwise. From such perspectives, letters are not official, literary texts, but they provide primary sources for which historical and literary research on material culture benefits from the pioneering studies of Carlo Ginzburg and Carlo Cipolla in microhistory. Books are objects as well, and so are letters discussing those books before and after printing, so that all those sources are bound to material history and their

own times.[26] Archival sources, thus, can consolidate written evidence from Renaissance and early modern times, and shed light on literary and scientific texts that were printed.[27] Indeed, correspondence documents material culture and the process of discussing both formal and informal ideas, as well as experiences and theories, some of which would be elaborated and published later.[28] At times, Galileo coded information not only to hide a message, but to get everyone interested in what was being withheld from them, to reinforce secrecy and promote his work and authorial persona.

Scientific information was alluded to, and withheld, in letters exchanged with Kepler, the Imperial Astronomer, and Emperor Rudolph II himself could not contain his marvel and curiosity. Kepler's frustrated attempts at deciphering Galileo's astronomical riddles gave rise to discussions of intriguing anagrams and mysteries that I will examine in the next chapter.[29] From the viewpoint of style, it is interesting to note that, to hide or project a parody of a theme, one needs a complete understanding of both the positive and negative aspects that are being conceited and transformed. In addition to textual proximities

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[26] On illustrated books, see Lina Bolzoni, *La stanza della memoria. Modelli letterari e iconografici nell'età della stampa* 221-27. For books as objects of culture, see the recent reflections by Jhumpa Lahiri in *Il vestito dei libri*. Milan: Ugo Guanda editore, 2017.

[27] For microhistorical methods, see Carlo M. Cipolla, *Cristofano and the Plague: A Study in the History of Public Health in the Age of Galileo*, Berkeley, University of California Press, 1973, and Carlo Ginzburg, *The Cheese and the Worms. The Cosmos of a Sixteenth-Century Miller*. Johns Hopkins University Press, 1980 and, by the same author, *Ecstasies: Deciphering the Witches Sabbath*, Chicago, University of Chicago Press 2004 [1989], (original Italian version, *Storia notturna*, Turin, Einaudi, 1989), as well as Ginzburg's book *Threads and Traces: True False Fictive*, University of California Press, Berkeley, 2012.

[28] Some of the letters were copied, transcribed, and circulated formally, as a sort of scientific papers before journals existed, with all secrecy and discretion required to protect authorship. As I will show in Chapter Two, Galileo used some cryptographic techniques for those letters that contained facts and speculations that the author wanted to validate among his friends. For a discussion of coded communication in Galileo's correspondence, see Hannah Marcus and Paula Findlen, "Deciphering Galileo: Communication and Secrecy before and after the Trial." *Renaissance Quarterly* Volume 72, Issue 3 Fall 2019, 953-95.

[29] Strategies to advertise, intrigue, and sell scientific inventions will be discussed for astronomy, physics, scientific instruments, but also medicine and pharmacology in Chapter Four. For wider audiences, marketing tendencies have been applied to communicative modes confirmed in the classical 1957 essay *The Hidden Persuaders* by journalist Vance Packard. See also Lina Bolzoni, *La stanza della memoria. Modelli letterari e iconografici nell'età della stampa* 103-11.

and analogies raised by the Book of Nature metaphor, and discussed in books and letters, one should not ignore the cultural consequences of the Counter Reformation begun by the Council of Trent (1545-1563), after which secrecy and religious approval cannot be underestimated. Among the theologians directly in conversation with Galileo on the book, the most influential were the Jesuits. William R. Shea has explained why it was important for Galileo to interact with Jesuit scholars, who were active researchers in mathematics and theology, to test, verify, and confirm his own theories and discoveries.[30] Based at the Roman College, they were the most active scholars in the Catholic Church. Christopher Clavius, the Jesuits' leading mathematician, was famous in Europe because he took part in the Gregorian calendar reform. Another important Jesuit scholar was Roberto Bellarmino, a theologian who had refuted what he saw as doctrinal confusions started by Martin Luther's Reformation.[31]

From the perspective of the Book of Nature metaphor leading this chapter, Galileo's science belongs to deep histories of the global Renaissance and early modern times. Accordingly, I concentrate my analytical attention as a reader and interpreter of facts in a global history and geography that, in Galileo's lifetime, benefits from a timespan of over fifty years of scientific and literary writings, a "longue durée" that historians in the French *Annales* School argued was necessary to understand and discuss historical events (Braudel 1982: 25-33). Few of Galileo's correspondents wrote from cities unconnected to Rome and

[30] I refer to Shea and Artigas's book as the main foundation for reframing Galileo's writings through the lens of correspondence and the networks associated with letter writers and letter recipients, too. In the case of the Jesuits, their role in intellectual investigations justified their active participation in scientific discussions, Galileo's theories included. See William R. Shea and Mariano Artigas. *Galileo in Rome: The Rise and Fall of a Troublesome Genius*. New York: Oxford University Press, 2005.

[31] Bellarmino became a Cardinal (1599) and was proclaimed Saint (1930). Biagioli argued that Galileo could not be a theologian, nor could theologians prove anything conclusive. See Biagioli's article, "Stress in the Book of Nature: The Supplemental Logic of Galileo's realism." *MLN* 118 (2003): 557-85; 584.

the Vatican, and some of those moved to Rome or out of Rome, as Giovanni Ciampoli who was sent away from Rome, to some small towns in central Italy Marche region, when Pope Urban VIII punished him after the *Dialogue* was published in 1632, for his support of Galileo. In Europe, cities associated to political and cultural institutions appear in Galileo's correspondence, for example with Galileo's correspondent Alfonso Antonini, a patron of the arts and military officer at the Service of the Venetian Republic, and the General States of United Provinces of the Low Countries. There are, however, urban clusters in Europe where several correspondents wrote, as did the astronomers Johannes Kepler, Thomas Seget, and Martin Hasdale, and the diplomats Giuliano de' Medici, Giovanni Pieroni, and Giovanni Marco Marci from Prague. The cultural dominance of Rome, Venice, and Florence among this majority group is further seen in that only a few correspondents wrote from Europe, Asia, and Africa. In rural areas, more people writing to Galileo were connected to academies, or to intellectuals and patrons, for example, in Acquasparta there was an early meeting place for the Accademia dei Lincei and a palace of the founding member, Prince Federico Cesi. That Academy was named after a lynx whose prodigious vision inspired its members to pursue investigations in science and the humanities with rigorous, close examinations. Though the academy only lasted in between 1604 and the death of his founder Cesi in 1630, Galileo continued signing his book frontispieces as a Lyncean academician ("Accademico Linceo").

3. Reading the Book of Nature through Wonder.

The Lyncean academicians wrote a preface to the *Assayer* dated 20 October 1623. Their enthusiasm derived in large part from the election of the new Pope, Urban VIII, who was known as an intellectual interested in the arts and sciences.[32] When he was still a Cardinal, Maffeo Barberini had communicated with Galileo, starting in March 1611, when common friends introduced them, and Galileo and Barberini exchanged several letters afterwards, showing reciprocal appreciation and even affection.[33] In the preface to *The Assayer* by the Lyncean academicians, astronomical novelties are real and legitimate facts:

> We bring, as a sample of our devotion, and as a tribute to our servitude, *The Assayer* by our own Galilei, the Florentine discoverer who revealed not new lands, but parts of the sky that had not been seen before. For these reasons, we must investigate those celestial splendors that usually bring about a greater wonder.[34]

The main values praised by the Lyncean academicians were the novelty and wonder of the scientific discoveries of Galileo, along with references to his astronomical studies as a symbolic form of geographic exploration of the skies, the result of which would be a new cultural environment and "the universal triumph of all humanities."[35] Since Galileo opened

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[32] Showing the support of the Lyncean academy was a strategic move in the Roman cultural establishments, particularly with the newly elected Pope (*OG* XIII, 129; 142; 146).

[33] Through the study of correspondence in Favaro's national edition of Galileo's works, it is shown that Cardinal Maffeo Barberini and Galileo were introduced by letter, thanks to the mediation of Michelangelo Buonarroti junior and Antonio de' Medici (*OG* XI, 72, 80-81). Cardinal Barberini was elected Pope Urban VIII (*OG* XIII, 120). One of the two daughters of Galileo's who were nuns commented about the election of the new Pope; see Suor Maria Celeste's letters on the new Pope (*OG* XIII, 120, 122, 127). Barberini admired Galileo and had attended public discussions in Florence on floating bodies (*OG* IV, 6; XI, 304 and 317). Galileo shared his astronomical discoveries on sunspots with him (*OG* XI, 305-11, 317, 322-23, and 495). Cardinal Maffeo Barberini expressed affection for Galileo (*OG* XI, 216; XIII, 118-19) and sent Galileo an ode he wrote in Latin, titled *Adulatio perniciosa* (*OG* XIII, 48-50).

[34] "Portiamo per saggio della nostra divozione, e per tributo della nostra servitù, il *Saggiatore* del nostro Galilei: del Fiorentino scopritore, non di nuove terre, ma di non più vedute parti del cielo. Questo contiene investigazioni di quegli splendori celesti, che maggior maraviglia sogliono apportare" (Preface to *Saggiatore*, *OG* VI, 201).

[35] "[…] universal giubilo delle buone lettere" (Preface, *OG* VI, 201). For the complex cultural connections between Galileo and the Accademia dei Lincei, see Eraldo Bellini, *Stili di pensiero nel Seicento italiano. Galileo, i Lincei, i Barberini* 67-101.

new fields to investigation, in science, then his role was comparable to those explorers who sailed to distant lands. The opening lines of the book solemnly confirmed a well-planned cultural circuit for the book. After the publication, the preface was an intellectual declaration for the author and the book, confirming its professional and authoritative background.

Early modern prefaces served as a form of cultural reference for the author and the readership, because addressing personalities in the preface would add prestige and authority for the author, and the book as a consequence of that exchanged value. In a sort of economy of credit in cultural communication, the book's inscription was written and signed collectively by the Lyncean academicians, then working as professional references endorsing Galileo's work.[36] It is uncommon for a book to present both a scientific and a literary aspect, as Eraldo Bellini has argued (Bellini 2009, 1-42). The book was dedicated to Pope Urban VIII, a man of literary education and taste who was interested in science, which confirms the exceptional nature of the book.

Wonder, Galileo believed, is a personal experience and needs to be such, so that readers can replicate the experience that the author described. In the Book of Nature metaphor, nature itself is a constant element whose general features do not change. Observers, instead, bring their subjective beliefs, feelings, and knowledge into the observation of nature as a book. The paradigm shifts of Kuhn's theory of Scientific Revolution(s) are once again productive in explaining that "though the world does not change with a change of paradigm, the scientist afterward works in a different world"

[36] The imagery of credit and debit in culture derives from a book by Salvatore Settis, *Il futuro del classico* (Torino: Einaudi, 2004). Here, I extend that concept to the circulation of a specific type of knowledge, science, and scientific discoveries in the early modern period.

(Kuhn 121). Therefore, the Book of Nature metaphor is a representation of scientific contents and the lens to look at those contents critically, regularities and anomalies included, through natural laws that explain them all. When books become important as carriers of meaning, "culture becomes a culture of books," Ernst Curtius wrote. In his studies, European literature seems to rely on knowledge deriving from books, regardless of the authority of writers and translators (Curtius 305).[37] In Galileo's case, books are written in a specific language, through a certain alphabet, with the advantage that the language and the deciphering key are the same one: mathematics.

Such ideas of units of meaning in an abstract Book of Nature, in turn, illuminate Galileo's reference to Platonic theories of an abstract idea existing in heaven, as opposed to an inferior manifestation of that idea in the material world we live in.[38] The image readers can visualize through the Book of Nature metaphor is simple, yet abstract and puzzling in its plain straightforwardness. While reflecting on book-related concepts, Galileo discussed notions that carry complex layers of meaning, such as "filosofia," "universo," "lingua matematica," "caratteri," "triangoli," "cerchi," "figure geometriche."[39] The language of expression for the Book of Nature was both the Italian vernacular and the language of mathematics. Not only did the writer master it, but readers should also have or gain ability in the language of mathematics in order to follow the author's scientific narrations. As a result of that acquired mathematical knowledge, readers would then be

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[37] Ernst Curtius, *European Literature and the Latin Middle Ages* 302-47.

[38] Galileo's Platonic tendencies were studied, among other matters, by Cassirer in *Galileo's Platonism* and Koyré's *Galileo and Plato*. An alternative reading is Biagioli's, who argued that the book of nature differs radically from Plato's conception of the book (Biagioli 570).

[39] See Carla Rita Palmerino, "The Mathematical Characters of Galilei's Book of Nature" in *The Book of Nature in Early Modern and Modern History*, ed. Klaas van Berkel and Arjo Vanderjagt (Groningen: Peeters, 2006): 27-44, and Peter Harrison, "The 'Book of Nature' and Early Modern Science," pp. 1-26, in the same edited volume.

independent interpreters of nature. The impact of such a cultural shift, introduced by Galileo, will show consequences and implications in scientific methods, as I investigate words and phrases traditionally belonging to the domains of mathematics. Philosophy is manifest in nature, so that natural philosophy personifies those values of observation and reflection. Nature, in its complexity, unfolds itself as a book does, and mathematics works as a sort of interpretative key to philosophy, supplying geometric figures as characters whose meanings are legible for the interpreters of nature who are knowledgeable in mathematics, the scientists.

Furthermore, the Book of Nature metaphor, explained through several levels of components, may contribute to a Baroque concept. As a result of the intersection of textual elements in the Book of Nature metaphor and the visual imagination encouraged in readers, scientific wonder and rhetorical wonder both occurred in writing. The Book of Nature passage is phrased as a metaphor and a powerful educational tool that belongs to the domain of rhetoric. One influential text was Emanuele Tesauro's *Il cannocchiale aristotelico* (*The Aristotelian Spyglass*), a monumental handbook that influenced political leaders and diplomats, preachers, and churchmen, but also public speakers and writers of any discipline. While Tesauro presented memorable descriptions and guidelines for all rhetorical devices, metaphors are the most explored topic he presented throughout the text. Though Tesauro's book found its way to publication in 1654, it was elaborated in earlier decades to summarize Baroque styles and expressions and the most effective communication techniques, and Tesauro was in favor of Galileo and the Copernican

system.[40] Galileo chose a metaphor to convey the important message that nature is a sort of book whose meaning becomes clearer from Tesauro's Baroque-inspired description of a metaphor and the wonder associated with it:

> [...] la più pellegrina, per la novità dell'ingegnoso accoppiamento. senza la qual novità, l'ingegno perde la sua gloria e la metafora la sua forza… Et di qui nasce la meraviglia: mentreche l'animo dell'uditore, dalla novità soprafatto, considera l'acutezza dell'ingegno rappresentante et la inaspettata imagine dell'obietto rappresentato (Tesauro 245).[41]

Not only metaphors are visual, imaginative, and creative forms to communicate, but they also generate other rhetorical devices. The effect of wonder resonates with Baroque ideals of grandiosity, style, and elegance that ruled over the arts and humanities, and extended to scientific writing. Outside of Italy, Johannes Kepler was supportive of Copernican arguments perhaps because of his early feelings filled him with surprise and admiration. Therefore, he expresses a feeling of wonder is found, and one that we will meet oftentimes both in scientific discoveries and Baroque esthetics:

> […] And how intense my pleasure was at this discovery can never be explained in words. I no longer regretted the time wasted. Day and night, I was consumed by compiling in order to see whether this idea would agree with the Copernican orbits, or if my joy would be carried away by the wind.[42]

For Kepler, a stratified, pervasive, and hidden metaphor in nature collects in one place many elements, from the language of the book as a natural expression form, to the physical characters that constitute the units of expression for a language. Additionally, the Book of

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[40] Maria Luisa Doglio called him "amico di Galileo e difensore acerrimo del sistema copernicano" ("Emanuele Tesauro e la parola che crea: metafora e potere della scrittura" in *Il Cannocchiale Aristotelico*, ed. Doglio. Savigliano, Editrice Artistica Piemontese, 2000: 9).

[41] "[...] the most unexpected, because of the novelty of the witty juxtaposition. without that novelty, wit loses its glory and the metaphor its force... Whence wonder arises: while the listener's soul, overwhelmed by novelty, considers the sharp wit of the author and the unexpected image of the represented object."

[42] From the Preface by Kepler in *Mysterium Cosmographicum*. *Gesammelte Werke* I (1938): 13.

Nature becomes an ideal book for Kepler who merged natural and divine considerations into his vision of science. As Kuhn maintained in the study of Scientific Revolutions, "paradigms provide scientists not only with a map but also with some of the directions essential for map-making" (Kuhn 109). To explore that concept of wonder and doubt, Galileo used another rhetorical technique in *The Assayer*, through a passage known as the fable on the origin of sounds. The main character is a nameless, clever, and extremely curious man ("d'una curiosità straordinaria"). The narration starts with the teaching one will derive from the fable itself, confirmed by experience and observations:

> Parmi d'aver per lunghe esperienze osservato, tale esser la condizione umana intorno alle cose intellettuali, che quanto altri meno ne intende e ne sa, tanto più risolutamente voglia discorrerne; e che, all'incontro, la moltitudine delle cose conosciute ed intese renda più lento ed irresoluto al sentenziare circa qualche novità (*OG* VI, 279).[43]

The description of such man's experience sounds like a fable, a genre that resonates well with Proppian modes of analysis. No name is given for the man, which might suggest each reader should imagine that experience for themselves. Furthermore, the narration resonates with Biblical narrations that often open with the recurrent conjunction "e" (Hebrew *ve*, "and") as a narrative connective resuming a story from times past (*OG* VI, 279).[44] As a hobby, that man raised several birds because he enjoyed birdsongs, but a critical event occurred when the man heard a noise nearby ("Accadde che una notte vicino a casa sua sentì un delicato suono").[45] In terms of Propp's analysis of fairy tales, hearing a sudden noise is a device that twists the plot and makes readers wonder what could happen next.

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[43] "It seems to me that such are human habits on intellectual topics: some people want to talk about something in a resolute manner, the more so the less they understand and know about something, as I observed many times in my experience. Conversely, once one knows and understands the many facets of a topic, the slower and less resolute they would be to give final opinions on some new topic."

[44] "[…] e con grandissima meraviglia andava osservando con che bell'artificio, colla stess'aria con la quale respiravano, ad arbitrio loro formavano canti diversi, e tutti soavissimi" (*OG* VI, 280).

[45] "One night, it happened that he heard a delicate sound, near his house..."

Little by little, the man discovered new ways to produce sounds that he learned by seeing a flute belonging to a shepherd, a violin played by a boy indoors, a door being opened, a man pressing his fingertips on the tip of a glass, in an inn, but also wasps, mosquitoes, bluebottles, and crickets breathing and flying, and many more cases in nature. Later, a cicada finally caught the man's attention, so he tried to find which body part produced sound from the cicada, but he ended up killing it. Therefore, that man recollected the cases met earlier in his search, which Galileo so narrated to us ("i modi narrati," "the narrated modes").[46]

Throughout his search on the origin of sounds, the man experienced astonishment ("stupor… ingegno… curiosità"), a feeling that people can relate to. At the same time, however, he started having doubts and questioned not only his senses, but his own knowledge before and after his exploration to understand how sounds are made. Therefore, when people asked him about the origin of sounds, that man answered that he "[…] knew about a few ways in which sounds occur, but he knew for sure one hundred more ways could also exist, unknown and unpredictable." Wonder was, then, a much stronger feeling, compared to his first impressions of knowledge as a certain and fixed set of facts and notions.

Galileo was consciously acting as a narrator in this passage, a presence that readers can infer from "many more examples to show the variety of nature and its marvels" ("Io

[46] On possible solutions to scientific queries, see a passage in which Galileo expressed his opinion sas a narrator, writing as follows: "Io potrei con altri molti essempi spiegar la ricchezza della natura nel produr suoi effetti con maniere inescogitabili da noi, quando il senso e l'esperienza non lo ci mostrasse, la quale anco talvolta non basta a supplire alla nostra incapacità; onde se io non saperò precisamente determinar la maniera della produzzion della cometa, non mi dovrà esser negata la scusa, e tanto più quant'io non mi son mai arrogato di poter ciò fare, conoscendo potere essere ch'ella si faccia in alcun modo lontano da ogni nostra immaginazione; e la difficoltà dell'intendere come si formi il canto della cicala, mentr'ella ci canta in mano, scusa di soverchio il non sapere come in tanta lontananza si generi la cometa" (*OG* VI, 287).

potrei con altri molti essempi spiegar la ricchezza della natura"). At the end of the narration, though, he encouraged the use of understanding and experience ("il senso e l'esperienza"). As the man in the fable could not find all ways to make sounds, so Galileo did not have precise, definitive answers on the origin of the comet. If we do not understand how a cicada can make sounds while we hold it in our hands, even less can we understand how a comet starts appearing, too, so far away from us. Galileo's inquisitive character in an apologue on sounds is persuasive and realistic because those textual descriptions are very evocative of visual elements in the fable, thus enhancing the learning experience for readers and conveying the author's message on the scientific method. Galileo used the Italian vernacular both to share astronomical discoveries and communicate in understandable, current terms. By doing so, Galileo was able to advertise both his own research work and his authorial persona, as will be shown in Chapter Two. Both rhetorical stratagems are found in *The Assayer* as helpful arguments to debate on comets and, more generally, on science.

4. Medieval to Early Modern Metaphors: Words, Signs, and Imagery.

A literary analysis of Galileo's imagery as a metaphor benefits from categorizations of metaphors by type. According to Tesauro's treatment of rhetorical tropes, Galileo's Book of Nature metaphor is an example of subdivided, redistributed concepts ("hipotiposi") whose "formal difference consists in representing the word with such energy, that our intellects can almost see the object, with our own eyes."[47] As found earlier, the visual elements of a metaphor (the Book of Nature) and a book (the frontispiece) are essential to elaborate on concepts such as nature. The visual arts have often complemented humanistic concepts and expanded their importance, a point that Galileo specifically acknowledged for nature and its representation as a book.

All the same, the Book of Nature metaphor was not an unprecedented rhetorical trope in Galileo's time, though, which is why I refer to its contexts and reception in order to show it is a re-invented metaphor, instead. In his survey of European and world literature, Ernst Curtius claimed that "[…] the use of writing and the book in figurative language occurs in all periods of world literature, but with characteristic differences which are determined by the course of the culture in general" (Curtius 303). There are many "metaphors from the book" (Curtius 303-310) historically, starting with the Old Testament, where Curtius noted cultural and religious interests for books as objects and repositories of knowledge. Curtius concluded that, with a few prior cases for the symbolic uses of books in religious texts, the Book of Nature metaphor originated in the late Middle Ages, when medieval scholars used it as a powerful rhetorical device for encyclopedic knowledge (Curtius 302-47; 319-32; Pitt). I complement Curtius's views with one medieval example

[47] "[…] la cui [ie. della metafora …] formal differenza consiste nel rappresentare il vocabulo con tanta vivezza, che la mente quasi con gli occhi corporali vegga l'obietto" (Tesauro 259-260).

particularly emblematic of such interpretation of nature, in the so-called Vienna Bible moralisée dating from the early thirteenth century (see Figure 2 below).

The illumination shows both views on nature as a comprehensive and unified world, detailed in its elements, presided by God as an architect, builder, geometer, and craftsman. In it, viewers can see both an overview of the universe and a measure of it in the elements of the universe. If we see nature as human viewers, the view of the universe requires an external observer, too, from God's viewpoint, whose knowledge of the world is mediated through a geometrical instrument, the compass. The external frame belongs to the Divine geometer who stands and reaches towards the spherical universe to measure the world with a compass. Additionally, books also have a normative value as repositories of knowledge. While the Bible imparts teachings for the devout, humanistic, and scientific books educate a nonprofessional readership in their respective disciplines. Scholar of metaphorology Hans Blumenberg finds it "ironic" that science fulfils its purposes in the "ideal textbook" that the Book of Nature would be, given that the "Author-God" created and authored both science and theology (Blumenberg 76). The Book of Nature metaphor stands between humanistic and scientific ideas, with the help of experience and textual authority as well.

Figure 2. God as Geometer, from the so-called Vienna Bible moralisée.
Codex Vindobonensis 2554, f.1 v (1220-1230 ca.), Austrian National Library.

In Galileo's Book of Nature metaphor, instead, letters ("caratteri") could be units conveying meaning both in nature and the spiritual world. In addition to the literal meaning of words, word origins (etymologies) also implied "everything of importance on the subject of the letters of the alphabet" as symbols ("signs") of things, showing "such power that they bring the speech of one absent to our ears without voice" (Curtius 313). Details in the universe form its units, which Galileo mentioned as characters and geometric shapes. Regarding those, Kepler added that further validation of the Book of Nature and its authority was found in letters by Saint Paul, who "reminds the heathens that in it they can contemplate God like the Sun in water or a mirror."[48]

The metaphor of the book, philosopher of science Joseph C. Pitt argues, conveys its meaning at first sight, but it also needs some interpretation beyond plain words (Pitt 1-8). The connection, in this case, is best exemplified by a formula deriving from classical times: "the marking of things" ("signatura rerum"). By looking closely at nature, its elements in their physical features are stones, animals, and plants, following the popular Renaissance concept of a "ladder of being" ("scala naturae") ranking everything that exists by degrees of complexity, feelings, and understanding. Based on external qualities of each thing on earth, a person would be able to rank that in the entire system that is nature – in this case, a collection, or a catalog of items, more than a book.[49] Stones, plants, and animals are creations of God's and, as such, they are at the service of humanity in everything

[48] Note the indirect contemplation of God, which Saint Paul had presented ("Videmus nunc per speculum in aenigmate, tunc autem facie ad faciem", 1 Corinthians 13:12). See also Rorty's *Mirror of Nature*.

[49] In Giovambattista Marino's poem, *Adone*, a flower and a book are the same thing, because the flower seems to renarrate the passion of Jesus Christ in its looks ("dentro le tue misteriose foglie / spieghi l'altrui salute e le sue doglie?" *Adone* VI, 141, 7-8; see also III, 121; III, 160, 7-8; VI, 138, XIV, 248, and Curtius 193-95). In Chapter Four, the "markings in things" will be explored for coral that was acquired by the Medici family in their collections because of a misunderstanding in the vernacular translation of the Ovid' *Metamorphoses* and Pliny's *Naturalis Historia*.

necessary for life, including health (Curtius 321-26). Nature encompasses its elements: plants, animals, and humans on Earth, as well as stars and planets in the universe.[50] Such secretive perspectives and a sense for riddles resonate, for example, in Shakespeare's play *Antony and Cleopatra* (1606 or 1607), when the oracle says: "In nature's infinite book of secrecy / A little I can read" (Act I, Scene 2). The uniqueness of each natural element exists in its usefulness for humans, thus making the economy of "marking in things" a practical one.

Scholars have contrasting opinions on the Book of Nature as a metaphor opposing, or complementing, the Bible. Mario Biagioli argued that Galileo was acting as an expert in the Book of Nature and the Bible, "two equally divine and true books," without necessarily mastering the contents of both, and to establish "a hierarchical relationship between theology and astronomy" in a "two-book package" (Biagioli 563, 568). He also noted such metaphor could refer to topics one could discuss through books solely.[51] Curtius found the highest prestige for books to derive from the Bible as the Holy Book in Christianity (Curtius 310), a textual counterpart which explains how the Book of Nature metaphor at times is paralleled with the Holy Scriptures, while Kuhn recognized "an actual language of observation" to be empowered in science through writing (Kuhn 121). According to Bellini, Pitt, and Baffetti, instead, the validity of the Book of Nature is questioned, without challenging contents from the Book of Nature or the Bible, as Biagioli had argued instead. Theological meanings of the Book of Nature metaphor seem to be missing in Galileo's metaphor, though.

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[50] The *Naturalis Historia* by Pliny the Elder abounds in such examples in the section on botany (Books XII-XXXII). Marino expressed correspondence as agency in a case of *sympatheia* (*Adone* XV, 41, 1, 3-8).

[51] "The power of solving disciplinary clashes was attributed to the books themselves, not to their readers. The book of nature, therefore, was a Trojan horse" (Biagioli 563).

Characters, individually and in group, seem to constitute Baroque symbols, so that such characters need to be interpreted as one interprets an enigma and an emblem, or explains a motto from a rhetorical perspective. Consequently, the value of such rhetorical stratagems is to stimulate one's intellect in deciphering them. While Galileo referred to the Holy Scriptures not in direct terms, in those years, Johannes Kepler had acknowledged the presence of the sacred in the study of the heavens. For Kepler, astronomers were priests of God as regards the Book of Nature, and he had acknowledged the Book of Nature as the book that is appreciated in the Holy Scriptures.[52] Thus, Kepler believed that the Book of Nature provided both divine principles and guidance for mankind, because "it is precisely the universe which is the Book of Nature in which God the Creator has revealed and depicted His essence and what He wills with man, in a wordless script." By seeing the sky, the celestial bodies, and their motions, astronomers served both as scientists and as theologians, thus following God's plan for them. Because of their scientific and religious status, astronomers can connect to the Divine. The Book of Nature metaphor, in Kepler's phrasing, turns into an allegory. If we think of astronomers from Kepler's perspective, as readers of nature, their perspectives are like the illustration of the moralized Bible I have presented, in which the imagery of measuring and understanding the universe from an external viewpoint, as God can do, connected astronomers and theologians to the Creator and Divine. There is an essential difference, though, as God is contemplating his own creation, whereas astronomers are contemplating God's design, which still requires mathematics to interpret the natural design of the sky. Kepler constructed an emblematic

[52] See Kepler's preface to *Mysterium Cosmographicum* (1596) for themes he developed later in *Epitome Astronomiae Copernicae* (1618).

image with a textual description of astronomers' duties, so that each of them sees the universe from Earth.

At the same time, it is the duty of the astronomers to conduct their research, to praise the Divine: "not... at the glory of [their] own spirit, but above everything else at the glory of God."[53] Kepler perceived his own scientific agenda to carry theological implications, too, which corresponded to his personal mystical experience. Kepler's book, *The Harmony of the World* (*Harmonices mundi libri V*), published in 1619, gave him great notoriety, and was a venue for him to share personal experiences of astronomy. He wrote:

> Since the dawn eight months ago, since the broad daylight three months ago, and since a few days ago when the Sun illuminated my wonderful speculations, nothing holds me back! I dare to confess frankly that I have stolen the Golden Vessels of the Egyptians to build a tabernacle for my God far from the bounds of Egypt… The die is cast, and I am writing the book, to be read now or by posterity, it matters not! It can wait a century for a reader, as God Himself waited six thousand years for a witness (*Harmonices mundi libri* V, *Proemium*. *Gesammelte Werke* VI, 1940: 290).

By connecting the sacred and the profane, Kepler had searched for biblical foundations to justify his statement and the mission he envisioned for astronomers. As the Jews had taken the golden vessels from the Egyptians to build their new religious object of devotion, so Kepler received the sunlight, symbolically, as an instrument to support his scientific thinking and writing. From such cultural endorsements, Kepler's arguments relied on texts by Saint Augustine in which he defended the transmission of knowledge, the so-called 'translatio studiorum.'[54]

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[53] See also Kepler's letter to Herwath von Hohenburg (26 March, 1598), *Gesammelte Werke* XIII, 1945: 193. Von Hohenburg was a statesman, scholar, correspondent and patron of Kepler, whose correspondence was studied by A.M. Clerke, "Kepler's Correspondence with Herwart von Hohenburg." *Nature* 34: 189–190 (1886).

[54] Particularly in Saint Augustine's "On Christian Doctrine" (*De doctrina Christiana* II, 40). The topic has been explored by Marco Sgarbi *in Translatio Studiorum. Ancient, Medieval and Modern Bearers of Intellectual History*. Leiden: Brill, 2012.

In order to reflect upon the value of the writer and the power and influence of his words and the opinions they express, I will now examine how books played a symbolic role in pre-modern texts.[55] One example of the authority attributed to books is found in the frontispiece to a popular Renaissance medical textbook, the *Fasciculus medicinae* (*Bundle of Medicine*) attributed to Johannes de Ketham (see Figure 3 below).[56] The book was published in 1491 (and as *Fasiculo de medicina*, in 1493), and republished in 1500, 1509, 1513, and 1522. The textbook was an authoritative reference for medical students and practitioners, with some physicians wearing medical books on their belts (girdle books) as a signifier of their status of experts.

In the frontispiece to the *Fasciculus medicinae*, a visual presentation centers around a lecturer in medicine, Petrus de Montagnana. [57] As was often the case in premodern books, frontispiece illustrations present visual statements of a book's purpose. In this case, there is also a rhetorical value in the image, which predicts from its visual cues many medical topics in the book. For example, a lecture takes place amid scientific books, while no students are seen and, in the foreground, some patients of different ages and gender (one

[55] For an analysis on authors and authority in the Middle Ages, see Michel Zimmerman, ed. *Auctor et auctoritas. invention et conformisme dans l'écriture médiévale: actes du colloque tenu à l'Université de Versailles-Saint-Quentin-en-Yvelines, 14-16 juin 1999*. Ecole des Chartes, 2001.

[56] The first edition was published in Venice (Joannes and Gregorius de Gregoriis, 1493), whose colophon referred to the group of medical essays as "Fasciculus medicinae of Johannes de Ketham." Note that the year 1493, Venetian calendar, corresponds to 1494. There is a facsimile and translation in *The* Fasciculus medicinae *of Johannes de Ketham, Alemanus: facsimile of the first (Venetian) edition of 1491*, trans. by Luke Demaitre. The commentary was by Karl Sudhoff, and it was translated and adapted by Charles Singer (Birmingham, Ala.: The Classics of Medicine Library, 1988). For historical contexts, history of the book, and medical humanities studies, see Jerome J. Bylebyl, "Interpreting the *Fasciculo* Anatomy Scene," *Journal of the History of Medicine and Allied Sciences* 45 (1990), pp. 285–316, and Ludwig Choulant, *History and Bibliography of Anatomic Illustration*, trans. and annotated by Mortimer Frank (New York: Hafner, 1962), pp. 115–119, but also Tiziana Pesenti, "Editoria medica tra Quattro e Cinquecento: L'*Articella* e il *Fasciculus medicine*," in Ezio Riondato, ed., *Trattati scientifici nel Veneto fra il XV e XVI secolo* (Venice: Università Internazionale dell'Arte, 1985), pp. 1–28.

[57] Tiziana Pesenti, ed. Fasiculo de medicina *in volgare*, Venezia, Giovanni e Gregorio De Gregori, 1494, 2 vols. (Treviso, Italy: Antilia, 2001).

boy and one man, and one woman) wait for a consultation with the lecturer-physician. At the bottom of the lecture auditorium, those three patients are next to small basket-like containers to have their urine examined. The study of medicine, based on books, became integrated with experience and medical practice, but the teaching is alluded to, as well, because students would be right next to the podium where the reader stands. Petrus stands at the podium as a lecturer, likely at Padua University where he was a professor. This image is especially relevant because medicine was a practical discipline open to graduates who were introduced to more technical subjects after completing a first academic degree in liberal art studies. While theoretical and practical sides of disciplines are distinct tasks in medicine, books connect the everyday routine of patient appointments to concepts studied and taught in university lectures. Through the perspective of medical history, from Aristotle to Petrus da Montagnana, the authoritative presence of a lecturer confirms the importance of the origins of medical knowledge and their public role in higher education. Books surround Petrus da Montagnana and the small, selected library of reference around him acts as a visual, cultural entourage made of texts. Particularly, the presence of Petrus de Montagnana as an exemplary lecturer is significant on the medical textbook's frontispiece because he showed philological care for the historical study of the origins and transmission of texts, and the genealogical connections among surviving copies of a text.

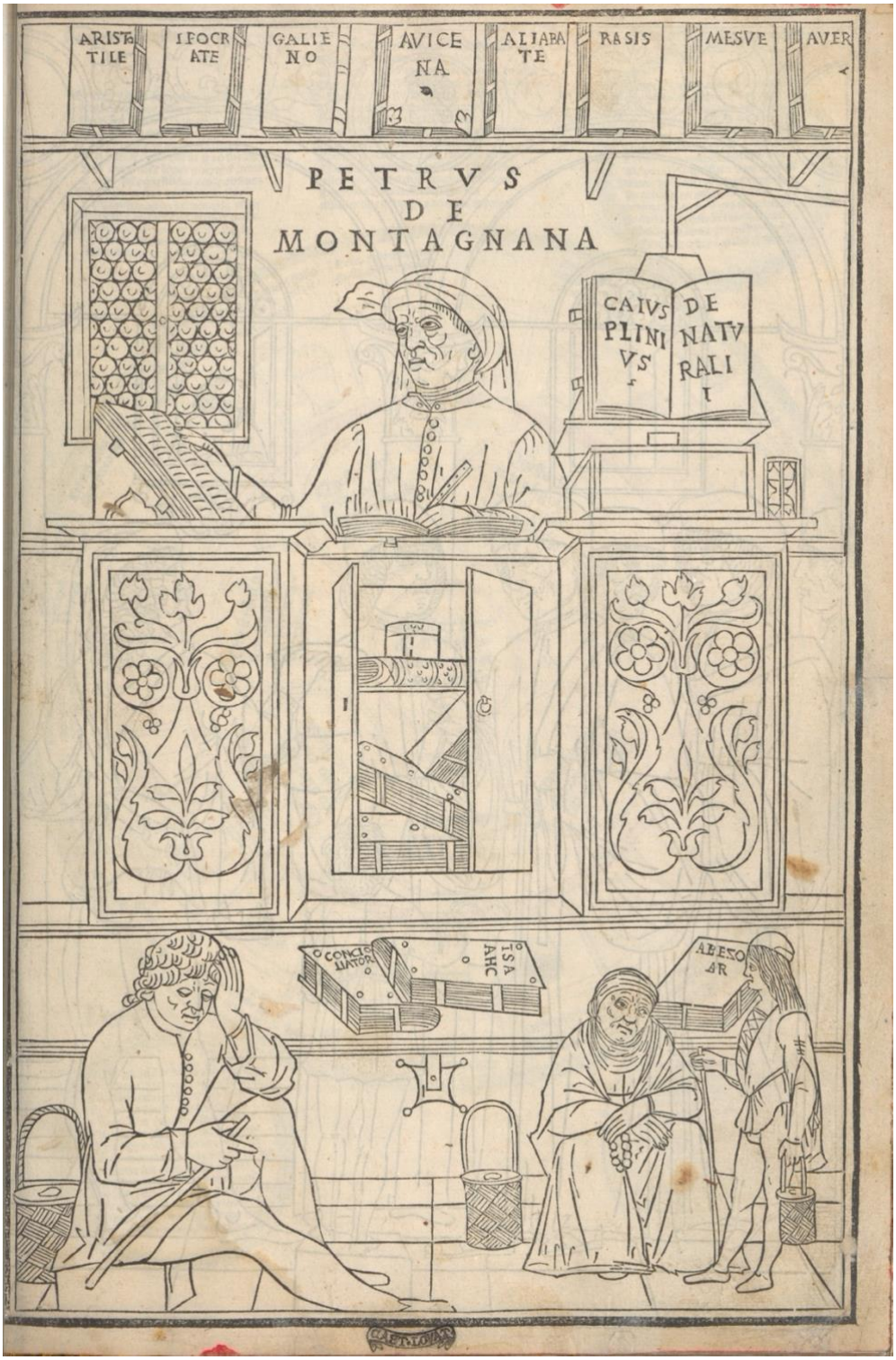

Figure 3. Frontispiece to the 1493 edition of *Fasciculus medicinae*.
Photo Courtesy of the National Library of Medicine, Bethesda, MD.

To the right of the lecturer in medicine, there is an unmarked, open book that he is reading, though only see some blank lines are shown, on which no text is readable. To his left, there is another open book with an inscription reading "Caius Plinius de naturali [historia]," and Pliny the Elder's encyclopedia in Latin was a standard reference of knowledge from the first century until the early modern period.[58] Above the lecturer's head, at the bottom of the platform, the main sources of theoretical medicine are on display. More books are present, marked by their authors' names, below the podium. Above the lecture's head, we see books marked by their author's names: Aristotle, Hippocrates, Galen, Ibn Sina [Avicenna], Haly Abbas, Rhazes, Mesues, Ibn Rushd [Averroes], Abezoar [Avenzoar], and Hunayn ibn Ishaq.[59] Books that confirm the lecturer's status and legitimacy are mostly marked by the name of their authors. The importance of authorship over the accuracy and clarity of contents was, thus, reinstated.

Connections between books and their authors show in the complex representation of a professor in a university classroom, where the lecturing space also opens to become a physician's office. By integrating his academic and professional roles, Petrus da Montagnana worked as a lecturer and practiced as a physician in the same academic environment in which the authority of books showed and validated his medical skills. Such significance of authors is subverted, instead, in Galileo's reinvented Book of Nature metaphor, in which contents and methods prevail more than the names of any authors. Galileo also showed high respect for books as material objects and repositories of

[58] A Renaissance revival in studies of Pliny's text had started in 1492, when the book was codified in its "correct" form by Ermolao Barbaro. Soon after it would be at the center of ignited discussions between the physician Nicolaus Leonicenus and the lawyer Pandolfo Collenuccio.

[59] It seems safe to assume that only one book is represented by its title, *Conciliator*, because the author Petrus d'Abano had been tried and condemned by the Inquisition. For information on the book edition and the names represented on the book frontispiece, see https://digitalcollections.nyam.org/digital/frontispiece.

knowledge, to judge from the extensive collection in his library consisting of over five hundred and eighty books. Furthermore, Galileo steadily showed his appreciation of written texts by curating, editing, and updating contents as well as language and style, which were traditional aspects of literature and a humanist's job.

For Galileo, Aristotle's texts were the starting point to reassess the study of nature, include observations, and share natural experiences available to anyone acquainted with the language of mathematics. Aristotle's treatises on logic, ethics, and zoology were often circulated as the philosopher's collected works and were considered, collectively, as a coherent corpus, though humanists started questioning their consistent composition and tradition. Therefore, referring to Aristotle's corpus of texts enabled scholars to use the phrase "ipse dixit," meaning "he said it himself" to invoke authority and gain credibility, starting from the phrase that Pythagoras and his followers used, regarding authority and personal beliefs. Knowing that one idea, philosophical or scientific, was traced back to Aristotle would increase its value, regardless of which books and contexts it came from, if it is from Aristotle himself. Because of the importance of nature in science, more than authorial prestige, Galileo shifted perspectives into contents and the language expressing those concepts. What Aristotle said did not matter so much in terms of truth because natural sources of information were the principal components of that book tradition, in the Book of Nature metaphor.

5. The Language of Mathematics and the View of Geometry.

As noted above, Galileo argued that mathematics is the reading key to the Book of Nature. Interpreting nature, furthermore, is a philosopher's task because it implies thinking norms, which explains why Galileo took pride in signing his works as a natural philosopher, that is the equivalent of the word 'scientist' today ("filosofo naturale"). Mathematics and geometry allow readers to develop their own observations once they become fluent in the language of the Book of Nature. Such view is optimistic, since everyone equipped with knowledge of geometry (and mathematics) can enter the field of interpreting nature, which is the same as saying science and scientific studies.[60]

Since the Middle Ages, the importance of mathematics had been auxiliary to philosophy, namely logic (dialectic), and medicine. In the thirteenth century, English mathematician and philosopher Roger Bacon had discussed the importance of mathematics as "a universal way to knowledge" and he admitted that "no science can be known without mathematics." Consequently, a natural philosopher "must know that he is ignorant and vacillating in almost any field if he is not previously instructed in mathematics."[61] The relevance of mathematics as a language and a perspective into the study of nature can lead interpretations towards "mathematical realism" that Biagioli interpreted as "a form of scriptural fundamentalism" (Biagioli 559). A contrasting view on the topic was advanced by Jesseph, a supporter of philosophical realism, who instead concluded that Galileo did not imagine the objects of mathematics to be representations of physical objects existing in nature, since elements of classical geometry such as points, lines, surfaces, and figures

[60] In Galileo's texts, mathematics was expressed in natural language, in prose. A level of abstraction in mathematical notations only became standardized at the end of the seventeenth century.
[61] Roger Bacon, *Opus maius* II, 172 ff. ed. J.M. Bridges, Oxford, 1897.

would be abstracted "Platonic" objects (Jesseph 205). Because of the abstract character of mathematics, the Book of Nature may display characters of an "idealized language of Platonic forms," whereas nature itself is "distinct from the mathematics that describe it." Furthermore, according to Jesseph, there was a consequence to Galileo's Book of Nature metaphor, in the presence of shapes, numbers, and motions (Jesseph 208). From Galileo's point of view, the knowledge one can get from books does not replace practical skills that one can only get by a familiarity with the language of mathematics. For those reasons, the Book of Nature metaphor was considered by Biagioli to be a "negative marker" before 1613. Furthermore, the use of the Book of Nature metaphor would introduce one fundamental difference between Aristotelian philosophers, "allegedly bound to their master's corpus" and "Galileo-style natural philosophers" who "allegedly accepted only the authority of empirical evidence" (Biagioli 564). In addition to that distinction, Biagioli also pointed out to another supposed fallacy in Galileo's Book of Nature metaphor, given that Aristotle's books are the work of a man, and commented by men, while the Book of Nature is the work of God who is infallible.

Through scientific debates in astronomy, backed up by mathematical calculations of circular orbital paths and durations, scientists wanted to show the truth. Scholar Baffetti concluded that problems arose, however, when the grammar of ordinary language did not agree with the cultural system that holds those "facts, principles, and grammar rules."[62] In order to have more exact perceptions of reality, scientists needed instruments, experiments,

[62] Baffetti's study builds on history of science scholarship, such as studies by Dijksterhuis, Popper, and Feyerabend studies ("fatti, principi e norme grammaticali" Baffetti 500-01). The underlying assumption seems to be that, if historians of science appreciate forgotten possibilities in the past, then literary scholars interpret extant books as sources for the author's liability to mistakes, their dialectic of conjectures and confutations, and their approval or criticism of traditional methods.

and ways to describe nature through qualities and quantities. While the telescope has been discussed by literary scholars (Baffetti), historians of science (Altieri Biagi, Finocchiaro, Siraisi, Biagioli), and philosophers of science (Pitt), the importance of instruments to help reading nature has not been fully acknowledged in scholarly interpretations of the Book of Nature metaphor. In several historical accounts of Galileo's use of man-made lenses to see the sky, it seems that "the telescope suddenly displayed mountains on the moon, the phases of Venus, and an immense number of previously unsuspected stars," so that Galileo's observations "brought the new theory a great many converts, particularly among non-astronomers" (Kuhn 154-55).

A shift in scientific ideas occurred for Galileo when he accepted Copernicus's notion of heliocentrism, thus replacing the Ptolemaic system. In a letter to Jacopo Mazzoni in 1597, Galileo showed an early appreciation of Copernicus.[63] Galileo highly praised the clearly defined theories by astronomers who went against tradition to find new results, and he could not "find an end to [his] admiration for how reason could go against our sensorial perceptions, in the case of theories by Aristarchus and Copernicus respectively, so that reason ruled their ingenuity."[64] Galileo mostly ignored Tycho Brahe's explanation of the universe that reconciled heliocentric and geocentric systems, throughout his books and letters, which both Biagioli and Jesseph agree posed a threat to the Book of Nature metaphor. Brahe's explanation of the universe not only valued geocentrism, but it also suggested that more than one reading was possible, so that the Book of Nature "was just a

[63] See *OG* II, 193-202.
[64] "Non posso trovar termine all'ammirazione mia come abbia possuto in Aristarco e nel Copernico far la ragion tanta violenza al senso, che contro a questo ella si sia fatta padrona della loro credulità" (*OG* VII, 355).

book, not nature itself" (Jesseph 201), thus confirming "[…] the logocentrism of the book of nature" (Biagioli 582). As Kuhn commented,

> […] a scientific community simultaneously renounces, as a fit subject for professional scrutiny, most of the books and articles in which that paradigm had been embodied. Scientific education makes use of no equivalent for the art museum or the library of classics, and the result is a sometimes drastic distortion in the scientist's perception of his discipline's past. More than the practitioners of other creative fields, he comes to see it as leading in a straight line to the discipline's present vantage. In short, he comes to see it as progress. No alternative is available to him while he remains in the old (Kuhn 167).

Scientific writing became an art that required rethinking, reframing, and adaptation to techniques and styles of persuasion.[65] Since Galileo used a captivating style, with the right proportion of rhetorical devices and stories, his books could stand out as memorable and be less intimidating topics to approach for non-astronomers, in a communicative mode that scholar Eraldo Bellini has shown to be conducive to non-specialist readerships.[66] Those who subscribed to Galileo's theories saw facts and read Galileo's texts and mathematical justifications as a new system of knowledge, so that they might agree with Galileo and reject the Ptolemaic system according to which the Earth is at the center of the universe. In addition, readers might also be persuaded to dismiss Ptolemy's authority and astronomical theories to embrace curiosity and mathematics from the Book of Nature metaphor.

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[65] In poems, linguistic and pedagogical themes interconnected were expressed by Marino as follows: "Per far distinto al vago sutil che vola / con lingua umana articolar sermone, / maestro qui non si richiede o scola" (Marino, *Adone* VII, 25, 1-3) and "[…] ma qual pittore, che 'ngegno e studio scopra / vie più che 'n grande in piccola figura, / nelle cose talora minime adopra / diligenza maggiore e maggior cura" (VII, 39, 3-6).

[66] "[…] far avvicinare alla discussione scientifica anche i non specialisti" (Bellini 29).

6. Writers' and Readers' Opinions.

As mentioned earlier, the interest of readers for *The Assayer* was very high and readers had a major role in interpreting such a Book of Nature. Kuhn believed that "[…] in the metaphorical no less than in the literal use of 'seeing,' interpretation begins where perception ends. The two processes are distinct moments in a book's production and promotion. In fact, what perception leaves for interpretation to complete depends drastically on the nature and amount of prior experience and training" (Kuhn 198). What Galileo achieved in his work *Il Saggiatore* was a renovated reading of the Book of Nature metaphor in a new scientific context. Both author and readers were looking forward to the book's release. Galileo took great care to his own books in print, circulation, and revision for further editions. Marketing and authorship reasons prompted Galileo to write to Prince Federico Cesi in Rome, from Florence, on 30 October 1623:

> Il *saggiatore* finito è aspettato qui da molti ansiosamente; ma dubito che la gran dilazione di tempo, causata prima da me e poi dalla stampa, non habbia a detrarre assai dal concetto che forse molti si havevano formato. Io non posso entrare a discorrer con V. E. sopra varii particolari, perchè tutti ricercherebbono lunga scrittura, onde io stimo assai meglio riserbargli a bocca (*OG* XIII, 144-45).[67]

Corroborating evidence of Galileo's editorial care is found in a letter Galileo wrote to Cardinal Federigo Borromeo (*OG*, VI, 14).[68] Both the possessive adjective ("mio") and careful revisions for correctness and propriety in styles and expressions point to Galileo as the author and intentional editor of *The Assayer*.[69] In addition to writing, revising his texts,

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[67] "*The Assayer*, completed by now, has generated many expectations by several people here, but I wonder if my delay, and the printer's, might have affected the opinion people had about it. I cannot enter in details with Your Lordship, because they all would take a lot of writing, so I prefer saving those for when we can discuss them in person…"

[68] "Mi vennero 8 giorni sono di Roma alcune copie del mio saggiatore [sic], ma così scorrette per negligenza del correttore, che mi è bisognato fare un indice degli errori, e stamparlo qui in Firenze e aggiugnerlo nel fine dell'opera" (quoted in Favaro's foreword, "Avvertimento").

[69] "L'ermeneutica del resto necessita sempre di una filologia propedeutica e complementare, e una delle procedure filologiche fondamentali è appunto quella della *emendatio*. Per il filologo l'errore è tecnicamente

and consulting experts in science and the humanities about his books, he also took six trips to Rome in his lifetime so that he could promote his ideas and advertise his scientific agenda as William Shea and Mariano Artigas have shown (*Galileo in Rome: The Rise and Fall of a Troublesome Genius*). Prince Cesi had previously warned Galileo to prepare before going to Rome to promote his astronomical ideas, and the two met in Acquasparta at Duke Cesi's family residence to discuss more details in person about Galileo's forthcoming trip to Rome (30 October 1623, *OG* XIII, 144).

Friends, among whom Tommaso Rinuccini, took care of negotiations with printers and prospective influential readers such as renowned humanists, scientists, and theologians. For those reasons, he wrote on 2 December 1623 from Rome to follow up on the recent editorial preparation of *The Assayer* (*OG* XIII, 154). The book index was not ready yet, and Rinuccini checked with Virginio Cesarini and other friends who could have been involved in the editorial revisions. Sarsi seemed enthusiastic about Galileo's book ("in un primo discorso fatto con un mio amico lodò assai V. S., dicendo che nella scrittura v'era del bono") and said he was going to write more about that astronomical debate in the Fall that year ("Intanto le posso dire che il primo dì il Padre Grassi fu [col] libraio che gli vende, e se ne fece dare uno, dicendo che V. S. l'haveva fatto stentare tre anni, ma che lui in tre mesi la voleva cavar di fastidio: non so poi come li basterà l'animo di mantener la parola"). Regarding Galileo's concerns, Rinuccini was certain that every scholar thought highly of him and his work, and was looking forward to seeing more of his works. Furthermore, Rinuccini assured Galileo that the Pope had read and appreciated the entire

una 'innovazione riconoscibile', e costituisce lo strumento privilegiato di un metodo induttivo che dal particolare risale al generale, determinando, attraverso un processo di 'successive ma parziali chiarificazioni', un quadro sistematico di legami e di relazioni" (Baffetti 505-06).

book.[70] The publication of *The Assayer* had been waited for so long, that Galileo's supporters were enthusiastic about it ("i servitori veri di V. S. con estremo contento"), many of them inquiring with discretion to see how people reacted to the book, particularly Grassi and Jesuit scholars, for whom the book was written to debate astronomical topics in public ("e molti andiamo spiando di ritrovare con qual toleranza d'animo sia visto e letto da quelli per i quali è particolarmente scritto, o, per dir meglio, ch'hanno dato materia di scrivere: e di tutto quello che si ritroverà, V. S. sarà ragguagliato"). If there was a scientific revolution in our understanding of the early modern period, there was also a revolution in reading tastes and the appreciation of book contents. In fact, scientific and medical literature in Italian became increasingly common in print in the sixteenth century. Not only did specific technical literature replace the tradition of Latin treatises and encyclopedias, it also supplied new contents, both theoretical and practical, bringing innovative words and new imagery into the Italian vocabulary. While a larger lexicon enriches a language, it has rarely been debated whether a more enhanced, and nuanced, vocabulary affects the way people think about a given topic, which shows clearly for topics that had some theological restriction for those of Catholic faith.[71] The discussion of Copernican theories was a matter of moderate caution after the 1616 warning imparted from Roberto Bellarmino to Galileo.[72]

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[70] "[…] so ben dir a V. S., e la posso assicurare, che lei sarà benissimo vista da tutti, et è desideratissima. e mi vien detto che il Papa (con tutte l'occupazioni) ha letto tutto il *saggiatore* [sic] con gran gusto."

[71] See Marchitello and Tribble, eds. *The Palgrave Handbook of Early Modern Literature and Science*. New York: Palgrave, 2017. For the role of the debate on language ("questione della lingua"), see Sperone Speroni's *Dialogo delle lingue*, and the discussion of cultural themes related to languages in Chapter Two.

[72] Johannes Kepler, the Imperial Astronomer, wrote from Prague that Copernican theories would still be a legitimate field to investigate, as they had been for over three generations by that time and would have been so, had Galileo not been "inconsiderate" (cfr. Galileo's letter to Kepler, *OG* X, 423).

The many interpretations of the Book of Nature metaphor also allude to the fact that the image evoked by this Book of Nature metaphor, in Galileo's phrasing, was new in its implications and differed, thus, from the medieval metaphor. In Olaf Pedersen's words,

> Over the ages the scientific description of nature has found it unavoidable to use a technical vocabulary of a more and more sophisticated character in order to gain precision and reduce ambiguity. But at the same time the general dialogue on the universe has often been framed in terms of metaphors that have been able to absorb and express some of the fundamental attitudes of man towards the world. Such metaphors can be nothing more than pictures which seem to present a part or the whole of the universe in analogy with something with which man has become familiar in his own world. As pictures they exist only in the eye of the beholder, consequently, they are always open to more than one interpretation (Pedersen 3).

While the wording of the Book of Nature metaphor was like earlier articulations of the concept of books as important repositories of information, the interpretations given of it were very different. Biagioli argued that logical principles of coherence and truth regulated Galileo's metaphor as much as they limited interferences from theologians. If there are two truths, they cannot contradict each other because nature and Scripture are God's work and both true. Astronomy and theology derive their qualities from nature and Scripture (Biagioli 562).

A reader who was interested in science and theology equally was Pope Urban VIII who had *The Assayer* read aloud to him during meals (*OG* XIII, 141, 146), and he also read the entire book on his own (*OG* XIII, 154). The Pontiff had been a science enthusiast committed to the study of astronomy since the days of corresponding with Galileo as Cardinal Maffeo Barberini, as early as April 1611 or before (*OG* XI, 72).[73] Another devout person, Galileo's daughter, the cloistered nun Suor Maria Celeste expressed to her father

[73] See Peter Dear, "Jesuit Mathematical Science and the Reconstitution of Experience in the Early Seventeenth Century," *Studies in History and Philosophy of Science* 18 (1987): 133-75.

the wish to see and read his book that had just been printed in October, because she had a great desire of seeing it (21 November 1623, *OG* XIII, 149).[74] Religious and secular readers, from Italy, Europe, and the British Isles followed Galileo's discoveries. Thomas Hobbes claimed that his "first business in London, was to seek for Galileos [sic] dialogues." In that same scientific circle, Robert Payne, Newcastle's chaplain, interested in science, translated *Della scienza meccanica* into English in 1636. Furthermore, Newcastle and Hobbes concentrated on the *Dialogue Concerning the Two Chief World Systems*, whose translation by Joseph Webb remained, however, unpublished (Jesseph 192-94. 196). Galileo's friend Fulgenzio Micanzio, a Servite friar, wrote a letter on 1 December 1635, referring to several visits from Northern Europeans ("molte visite di oltramontani" *OG* XVI, 355).[75]

The interest for *The Assayer* did not decline and many years later the same Micanzio wrote from Venice on 4 November 1634 to praise Galileo's writing and to express his frustration. By then, it was difficult to find a copy of the *Discourse on the Comet*, attributed to Mario Guiducci, to purchase.[76] One year after the Inquisition trial, the circulation of any books by Galileo, or connected to them, before or after the controversial

[74] From a relationship with a Venetian woman, Marina Gamba, Galileo had three children: Virginia (later suor Maria Celeste), Livia (later suor Arcangela), and Vincenzio.

[75] Influences of Galileo's works on later scholars have been studied by Pedersen (61-87) in a section of his book that he called "The Impact of Time." Jesseph argued that one of those scholars was young Hobbes: "The centerpiece of Hobbes's new analysis by the method of motion is chapter 16 of *De Corpore*, which bears the title 'On Accelerated and Uniform Motion, and on Motion by Concourse'... this chapter was lifted almost straight out of Galileo's *Two New Sciences*" (204). Pedersen also wrote that "Hobbes and the earl of Devonshire journeyed to Italy late in 1635, remaining in Italy until the spring of 1636 when they made their way back to Paris. During this tour Hobbes met Galileo, although the dates and details of the meeting are not altogether clear" (Jesseph 196).

[76] In Venice, Micanzio had the opportunity to hear friar Paolo Sarpi, with whom he closely communicated during and after the Interdict (1605).

1632 *Dialogue*, was impacted by religious regulations, so that the 1618 book was out of sale. Friar Micanzio liked *The Assayer* very much because of its study of nature and style:

> Ho letto tutto il *saggiatore* con il contento che non potrei mai esprimere. È gran cosa come Dio, la natura e lo studio, la facia [sic] osservare tutto, da tutto cavare specolationi altissime, nuove, singolari, fondate; et essa versi in che materia si voglia, non può non insegnare a chi non ha la superbia di credersi saputo o la malvagità d'invidiare l'altrui ingegno e lode... Ma, buono Dio, quante cose pellegrine gli è stato occasione di donare al mondo!... le confesso e giuro che come esco dalla lettura delle cose sue, non ci trovo che noia, et il repetere la lettura delle sue ha d'essere l'impiego di tutto il tempo che m'avanza... Mi resta però sempre impresso quello soleva dire esso buon Padre [Paolo Sarpi], che la natura produce in certe età ingegni atti a certe contemplationi, che se da loro non vengono toccate, non vi resta più speranza di conseguirle; e portava l'essempio di V. S. nel moto, e diceva a tutti che ella in questo non haveva mai havuto pari, nè credeva fosse per haverlo (*OG* XVI, 150-51).[77]

In *The Assayer*, readers found a Book of Nature metaphor whose importance is such that nature can be encapsulated into it, as a book of natural philosophy that is science. Discussions on science through Galileo's texts were so important in the field of astronomy, that his supporters found it necessary to defend arguments based on books and their factual evidence. As late as 1634, in Venice, when friar Fulgenzio Micanzio witnessed a contested scientific discovery, and he asked for validation, seeking to find in Kepler's books what Galileo had concluded upon motions: "one scholar truly prepared in philosophy and more...

[77] "I read all *The Assayer* with such joy that I could never express it in words. It is a wonder how you observe everything with the help of God, nature, and study, and how you derive such high, original, and motivated observations from everything. In any discipline to which you apply yourself, you end up teaching something to those who do not have the arrogance to consider themselves learned, or the ill wish to envy others' wits and praise... Well, good Lord, how many new things you had the opportunity to give the world! I will confess to you that as soon as I read something that was not written by you, I am just bored, so that I will spend the rest of my days reading your books over and over. Now I have another request from you... I keep thinking about what Father [Paolo Sarpi] used to say, that nature generates, in certain periods, minds suitable for certain observations, and if these people do not pursue them, there is no hope to achieve them. He used you as an example, regarding the study of motion, on which topic he said there was, and never would be, anyone like you."

does not deny the value of [Galileo's] discoveries... says that those are not new theories, but Kepler's".[78]

The Book of Nature metaphor was a novelty in scientific literature, borrowed from philosophical and doctrinal fields of inquiry. In the chronological landing point for the current analysis in 1632, the alphabet turned out to be a fundamental element of the Book of Nature metaphor: as we read in *Dialogue*, at the end of the first day:

> [...] surpassing all stupendous inventions, what sublimity of mind was his who dreamed of finding means to communicate his deepest thoughts to any other person though distant by mighty intervals of place and time! Of talking with those who are in India. of speaking to those who are not yet born and will not be born for a thousand or ten thousand years, and with what facility, by the different arrangements of twenty characters upon a page! (Galilei, trans. Drake 2001, 120-21).

The passage quoted above praises the act of writing and the long-lasting effect of communicating with any literate audience through texts. What Kuhn suggested to see in terms of social and cultural circumstances, before and after scientific discoveries respectively, is investigated here in terms of concurrent metaphors. The Scientific Revolution occurred first in astronomy and later in physics and medicine (Kuhn 200), which will bring my analysis to the medical field in Chapters Three and Four. Imagery and metaphors compare with other cultures from other lands and other times. What transferred, metaphorically and not so, from all disciplines dealing with science was in terms of experimental mindset and writing practices.

[78] "È qui un virtuoso e veramente intendente nelle filosofie ordinarie e qualche cosa più, quale, sovente che si tratta di lei, non nega la virtù, ma dice che le cose da lei portate non sono nove, ma già del Cheplero. Io le dissi l'altro giorno in Libraria, che di gratia mi favorisse farmi vedere nel Keplero le specolationi portate da V. S. intorno al moto. Viddi havere fatto piacere a' virtuosi di serrarli la bocca" (*OG* XVI, 150-51).

7. Concurrent Natural Views, Metaphors, and Symbols.

The Book of Nature metaphor contains layers of meaning and potential connections to other concepts, among which the Book of Philosophy, the Holy Scriptures, and the alphabet as limitless resources of contents. As concurrent book metaphors, they served rhetorical purposes and referred to other domains in human culture and history. From such initial considerations, I suggest we think of those foundational metaphors for the scientific method as narrative experiments. Furthermore, innovations in writing and the subtle variations on a long-existing metaphor were possible because of a confident approach to literature and the publication of scientific findings. For Galileo, it seems confirmed as true what commonsense suggests, that a good writer is often a good reader, along which lines Lina Bolzoni has devoted a section of her recent book to the study of Galileo as a literary critic (*La stanza della memoria. Modelli letterari e iconografici nell'età della stampa* 210-17). The editor of Galileo's national edition, Antonio Favaro, argued that Ariosto was Galileo's favorite author and that he knew the poem by heart.[79] Galileo did not like Tasso, but he still knew his books very well, and he enjoyed Berni and Ruzante in his free time, as we learn indirectly through Sagredo's recommendation that Galileo should read to relax, thus enjoy comedy during his recovery and not only study mathematics and philosophy in books written by Aristotle and Archimedes (*OG* XII, 156-58).

A textual experiment of Galileo is found in a "capitolo bernesco," a satirical poem that he wrote to criticize current customs and traditions.[80] In a poem against the donning

[79] Galileo sometimes suggested textual variants to Ariosto's epic by annotating his own copy, and his comments were based on the metric structure and the meaning of words both taken individually and in the context of the passage. The marginal notes that Galileo wrote on his copy of *Orlando Furioso* were published as an autonomous text in Favaro's edition (*OG* IX, 149-94).

[80] See Silvia Longhi, 'Lusus'. *Il capitolo burlesco nel Cinquecento*. Padova: Antenore, 1983; Danilo Romei, *Roma 1532-1537* in *Da Leone X a Clemente VII. Scrittori toscani nella Roma dei Papi medicei (1513-1534)*.

of the professorial gown, titled *Capitolo contro il portar la toga*, Galileo examined the work of a scholar and scientist in details that he could criticize, in a parody, to defend his own personal values.[81] Galileo speculated why reasons why traditions and innovations exerted such influence and met such resistance, and had the courage to denounce formal practices and customs that he considered wrong in academia. In that poem, Galileo modulated the Book of Nature metaphor in its components, but he also criticized the role of astrology in explaining celestial bodies. As a personified entity, nature teaches. Does that imply that life on earth, namely life for humans, is not regulated by astrological motions? ("E se tu credi che questa sia bella, / E' bisogna che 'n cielo, al parer mio, / Regni qualche pianeto o qualche stella," Lines 139-41).

In the satirical poem, Galileo investigated the nature of clothing. The paradoxical conclusion is that the best thing for people is nudism ("'l sommo ben sarebbe andare ignudo," Line 48). By arguing that luxury clothes and professional garments are an unnecessary perversion of a natural condition, the naked body, Galileo discussed economy and authentic values. In a utopian fancy, he would prefer nudism to donning the gown, going back to an ideal time in antiquity, since books describe those times and people as happy.[82] In an idyllic, past, this was the norm, and we have a record of such habits through books ("Come dicon i libri che lo sanno," Line 57). Galileo's comment on books as the sole source of information available on this matter is also paradoxical. On one hand, he built the Book of Nature metaphor on books as a repository of knowledge, thus a

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Manziana: Vecchiarelli, 2007, pp. 205-242, and Paolo Orvieto and Lucia Brestolini. *La poesia comico-realistica. Dalle origini al Cinquecento*. Roma: Carocci, 2000.

[81] On the functions of humor and laughter, see Tesauro; on visual aspects of science, see Pietro Greco, *Galileo Galilei, The Tuscan Artist*. New York: Springer, 2018.

[82] "Volgiti a quel felice tempo antico, / Privo d'ogni malizia e d'ogni inganno, / Ch'ebbe sì la natura e 'l cielo amico. / E troverai che tutto quanto l'anno / Andava nud'ognun, picciol e grande, / Come dicon i libri che lo sanno" (Lines 52- 57).

commodity of value, whereas on the other hand, he could not accept traditional concepts without questioning them. Therefore, the memory of concepts preserved through books seemed an irrational act of faith. More than all considerations, the lack of scientific agency and personal agency concerned Galileo particularly.

As a professor himself, Galileo found it troubling that some colleagues followed tradition and missed the opportunity to pursue truth independently in their research. He believed they were looking for truth in the wrong place ("E mi vo col cervello immaginando, / Che questa cosa solamente avviene / Perchè [sic] non è dove lo van cercando," Lines 4-6).[83] Professors wearing formal gowns would also stand out in a crowd, which would imply avoiding questionable frequentations ("Dicon ch'è grave errore, e troppo importa, / Ch'un dottor vadia a casa le puttane: / La togal gravità non lo comporta," Lines 175-77). Cultural features are also important in matters of clothing because the professorial gown resembles Jewish traditional clothes, according to Galileo, and he readily dismissed any connection to Judaism despite his name and family names meaning "from Galilee" ("Ma ch'io sia per voler portar la toga, / Come s'io fussi qualche Fariseo, / O qualche scriba o archisinagoga, / Non lo pensar, ch'io non son mica Ebreo, / Se bene e' pare al nome e al casato / Ch'io sia disceso da qualche Giudeo" Lines 148-53).[84]

In Galileo's opinion, traditional scholars had trouble finding a good way to solve their quest for truth, "il sommo bene" ("Questi dottor non l'han mai intesa bene, / Mai son entrati per la buona via, / Che gli possa condurre al sommo bene," Lines 7-9). The path to

[83] Here, and in passages quoted from Favaro's edition of Galileo's collected works, the accent respects the spelling of the time, not current orthographic conventions in written Italian in our times.

[84] The reference was made later, when preacher Tommaso Caccini gave a sermon in the church of Santa Maria Novella in Florence, in which he implicitly criticized Galileo and his followers by referring to a passage from the Gospels ("Viri Galilaei" from chapter 1, verse 11 of *The Acts of the Apostles*, "Viri Galilaei, quid statis adspicientes in caelum?" as a pun and reference to Galileo and his followers).

proper knowledge is presented as a metaphor that can lead to truth ("sommo bene"), and that path is called 'methodos' in Greek, from which the modern word 'method' derives. As a result of scientific inquiries, Galileo would eventually start a new scientific method by resorting to creativity and the only practical way seems to be what he imagined with his own creativity ("mi vo col cervello immaginando").

How should scientists be inventive, though? There are many ways to experiment with changes in thinking habits and patterns, as "Lo stil dell'invenzione è molto vario" (Line 19). According to rhetoric, in fact, "invenzione" is the act of discovering ("invenire," in Latin) and Galileo recounted his own experience, this is a method to understand values that are at the opposite end ("Ma per trovar il bene io ho provato / Che bisogna proceder pel contrario," Lines 20-21).[85] If one wants to find patterns in nature, it helps to have guidelines in the inquiry which Galileo called "una ricetta generale." According to his intuition, one should learn about circumstances from experiences, so that fasting and abundance are perceived as different ("Chi vuol saper che cosa è l'astinenza. / Trovi prima che cosa è 'l carnovale, / E ponga tra di lor la differenza," Lines 25-27). Therefore, creativity and the ability to conjure up new imagery, as well as new concepts, have the potential to develop new methods and new results. In support of such ways, nature seems to be teaching us to follow nature only ("Questo par che c'insegni la natura," Line 16).

While all those considerations were jocose, Galileo also insisted on values of intellectual honesty for over three hundred lines in the poem.[86] When people did not wear

[85] In this passage, Galileo is clearly paying an homage to the opening lines of Dante's journey in the otherworld: "ma per trattare del ben ch'i' vi trovai, / Dirò dell'altre cose che v'ho scorte" (Dante, *Inf.* I, 8-9). Written in terza rima, like Dante's *Commedia*, several passages of the *Capitolo contro il portar la toga*, parody the great prophetic poem.

[86] "E perchè vegghi che quel ch'io ho detto / chiaro e certo e sta com'io lo dico, / Al senso e alla ragion te ne rimetto" (Lines 49-51).

clothes, the direct observation of bodies was easier and there was no need to make conjectures ("[...] affaticar l'ingegno / A strolagar per via d'architettura, / O 'ndovinar da qualche contrassegno: / Non occorreva andar per cognettura [sic]," Lines 64-67). In such parody of logical reasoning and induction, Galileo added details on weight and measuring, the same practices of merchants ("Perchè la roba stava in su la mostra, / E si vendeva a peso e a misura," Lines 68-69). Through a parody of weighing and sale practices, Galileo could compare market habits to the observation and comparison of human bodies, when physical double-checking was meant to exclude signs possibly associated with venereal diseases. Clothes conceal the body just as rhetorical flourishes obscure thinking, he suggested, tongue in cheek. "Non si temeva allor del mal franzese: / Però che, stand'ignudo alla campagna, / S'un avea qualche male, era palese" (Lines 88-90). Observing naked human bodies allowed people to choose a spouse safely. Consequently, one could have no fear of syphilis ("mal franzese").[87] At the time of going naked, reason prevailed in an ideal society that Galileo described in verses. In that society, everyone used reason as a guide to their behavior ("Ognun si stava ragionevolmente," Line 116). Galileo argued that men are like wine bottles because contents, not looks matter, whether those external features were related to clothing, national origins, or religious devotion. It is not the writing style that makes a difference, but the contents of what is being conveyed ("Anzi vo' dirti una mia fantasia, / Che gli uomini son fatti com'i fiaschi," Lines 284-85).

According to Galileo, it would be natural if everyone walked around naked, so that people should refuse to wear clothes. In his view, wearing clothes, using weapons, and

[87] Supposedly, that meant that seeing naked bodies allowed the viewer to see if there had been any signs of the disease (rash, boils, swellings), though it is implicitly referred to signs of venereal diseases. For further discussion of physical and psychological signs of diseases, see Chapter Four.

resorting to magic are evil inventions (Lines 122-26). In making such assertion, Galileo paid homage to one of his favorite authors, Ludovico Ariosto and his epic poem, *Orlando Furioso*, in which the poet condemned the invention of weapons ("archibugio" in *Orlando Furioso* XI, 23-28). Those inventions derived from astute manipulators, Galileo stated ("Sappi che questi tratti tutti quanti / Furon trovati da qualcuno astuto, / Per dar canzone e pasto agl'ignoranti" Lines 271-73). Luxurious clothes do not mean anything either ("Il resto, quando sia di romagnuolo, / Non vuol dir nulla, se ben par che questa / Sia una sottigliezza da Spagnuolo: / E non importa che tu ti rivesta, / Mutand'abiti e foggie a tutte l'ore, / Se è dì di lavoro o dì di festa," Lines 196-201). As mentioned earlier, clothes conditions and looks, national origins, and so, religious beliefs, and so formal or informal conversations do not matter, which could be an allusion to the perceived artificiality of Spanish customs and dress styles. Being from Turkey or from Bergamo, as well as addressing someone informally or formally are irrelevant cultural traits when one investigates what a man is, essentially ("Ch'importa aver le vesti rotte o intere, / Che gli uomini sien Turchi o Bergamaschi, / Che se gli dia del *Tu* o del *Messere*?" 280-82).

Galileo made it a priority to write in a style, language, and vocabulary that should match contents, no matter how many followers, supporters, and university enrollments could confirm a scholar's reputation ("Quand'egli ha intorn'a sè diciott'o venti, / Che, per udirlo, a bocca aperta stanno," Lines 218-19). Through a new scientific language in the Italian vernacular, Galileo also contributed to expanding the literary horizons of the Italian vocabulary. He did not disdain any communicative means, including thieves' jargon in Italian that will be discussed in Chapter Two.[88] As he had warned in his jocose poem,

[88] For an analysis of "gergo" and ciphered communication, Marcus and Findlen wrote that "[…] just as properly joining characters made meaning, mixing them up created nonsense, whether accidentally or

creativity and imagery are important to achieve results ("A chi vuol una cosa ritrovare, / Bisogna adoperar la fantasia, / E giocar d'invenzione, e 'ndovinare. / E se tu non puoi ire a dirittura, / Mill'altre vie ti posson aiutare," Lines 11-15).[89]

Thinking about new scientific concepts means also assessing the role of earlier readings, training, education, and cultural influences. In Galileo's case, he was not raised as a strict Aristotelian during his education at the University of Pisa. On the contrary, he was trained to investigate motions according to the impetus theory and Aristotelian dynamics, as well as the properties and motions and forces dating back from the late Middle Ages (Kuhn 119). As divine revelations found expression in written texts to communicate guidance and regulations for people's lives, the Book of Nature inspired human comprehension and became useful for practical applications derivable from it.[90] Galileo relied on thought experiments, in lack of proper conditions and tools to verify natural phenomena. Regarding thought experiments, Nersessian commented on "imagistic representation" as follows:

> Although the literature on imagery in both cognitive science and science studies concentrates on the visual modality, quite likely representations in the format of the full range of sensory modalities can be utilized in model-based reasoning. Galileo, for instance, conducted experiments in which he strung bells along the path of an object rolling down an inclined plane to discover if he could hear the changes in speed – through changes in frequency of pitch – that were too rapid to be seen (Nersessian 159).

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deliberately. In the end, Galileo was suggesting that Simplicio practiced an absurd philosophical *gergo* through his method of reading ancient authors" (Marcus and Findlen 978).

[89] Italo Calvino found models for his thinking in Galileo, Ariosto, and Dante as well. Thus, when he commented about creativity with the words, "la fantasia è un posto dove ci piove dentro," he was echoing influences from Galileo, but also Dante's lines in *Purg*. XVII, "Poi piovve dentro a l'alta fantasia" (*Lezioni americane*).

[90] For a history of science, technology, and medicine, see David Lindberg, *The Beginnings of Western Science, subtitled The European Scientific Tradition in Philosophical, Religious, and Institutional Context, 600 B.C. to A.D. 1450*. Chicago: University of Chicago Press, 1992. Some historical and philosophical insights were commented by Baffetti, in particular views by Dijksterhuis, Feyerabend, and Popper.

Fictional representations are not only word-based because they employ images to show correspondences between objects and artworks. The poet Giambattista Marino conveyed both verbal and visual clues to the new science, methods, and understandings of the natural world through textual descriptions of artworks. In his view, art aims at mirroring nature, at the concrete as well as at the abstract level does the discipline of art mirror the study of science: "Nature admires the work, which is produced by art and almost breathes, as if it were her offspring" ("L'opra, ch'opra è del'arte e quasi spira, / com'opra di sua man, Natura ammira," *Adone* II, 22, 7-8).[91] The double correspondence between concrete and abstract units derives most of his elements from Plato's philosophy. Since such connections between written texts and visual elements exist at the conceptual level, writers have a duty to ornate and perfect words, texts, and any verbal expression, whether in poetry or prose. Textual description is, then, inflated by poetical treatment: "Nature distributes things / and Art dresses what Nature gave" ("Natura dele [sic] cose è dispensiera / l'Arte condisce quel ch'ella dispensa," *Adone* VII, 157, 1-2).

Because of the ambivalent connection to Aristotle and his medieval commentators, scholars' opinions oscillate between metaphor and topos about the imagery of the Book of Nature. Biagioli argued that Galileo "turned this topos on its head and stated that the reading of the book of nature was not a matter of interpretation" (Biagioli, *Modern Language Notes* 2017: 557). Biagioli also suggested that the Book of Nature is nature itself, being "truth to be sought in the world and in nature" (Biagioli 564-65). The argument that the book of the world "seems almost identical" to the Book of Nature would furthermore

[91] The passage translates as "The artwork, that is a work of art and seems to breathe / Nature admires it, as if it were a work of its own." On Galileo and the arts, see Erwin Panofsky, "Galileo as a Critic of the Arts: Aesthetic Attitude and Scientific Thought," *Isis* Vol. 47, No. 1 (1956): 3-15.

contrast with “the opacity of the Aristotelian corpus or any other form of human writing” which Biagioli claimed that Galileo addressed in 1613-15 (Biagioli 565). So far, I have examined the presence and influence of the Book of Nature metaphor in early modern scientific writing, most notably in Galileo’s works. I have analyzed contexts for the Book of Nature metaphor and understood it to be an advanced verbal expression for a concept that was visual, theoretical, and encompassed the humanities as well as the sciences, and the selected timeframe is, to the best of my knowledge, an innovation of the current study. Next, through literary and historical analysis, I will consider poetry and prose as textual modes justifying scientific pursuits to explain their contents and popularize new discoveries, with attention for the mnemonic and pedagogical values of such scientific practices.

Chapter Two. "Seeing through Metaphors: Humanistic Words for Scientific Ideas."

1. Writing about Nature.

The introduction of the Book of Nature metaphor promoted and renewed interests in the study of nature, whose results Galileo would discuss in the Italian vernacular. Galileo's interests in communication, clarity, and outreach dated back to 1597, when he wrote a letter to congratulate Jacopo Mazzoni, his former teacher, on the new book he had published recently to discuss Aristotle and Plato. To give one example of how theories and ideas are supported and communicated, Galileo asked if one could "save Copernicus" and validate the motion and position of the Earth that Copernicus proposed (*OG* II, 198, 202). He also argued that language is the key element to a successful communication, adding that how we speak affects the way we are understood as authors of literary texts but also technical contents (*OG* II, 197-202).[92]

Considering Galileo's humanistic education and receptivity, this chapter will examine scientific communication in Galileo's books and letters to ascertain how neologisms, translations, and rhetorical tropes affected his descriptions of nature. In particular, new discoveries became exemplary cases in writing, providing anecdotes to

[92] Galileo circulated the letter to Mazzoni among his closest friends; however, no autograph copies have survived today. As his editor Favaro noted, the letter to Mazzoni is a sort of open letter: "La presente scrittura di Galileo, quantunque stesa sotto forma di lettera al suo amico e maestro Iacopo Mazzoni, ha del documento epistolare soltanto la forma, e perciò le abbiamo assegnato il posto che essa viene ad occupare tra le cose di Galileo secondo l'esatto ordine cronologico" (*OG* II, 195). Only two contemporary copies of that letter are extant today, of which one originally belonged to Pinelli's library (Biblioteca Ambrosiana, Milan) and shows corrections of serious mistakes of the copyist, which could prove Galileo's reading of the letter and revision of it, and another copy at the Palatin Library in Vienna.

validate arguments, explain complex concepts, and persuade readers the way examples do in humanistic contexts, or in Baroque poems on scientific themes.

2. Scientific Humanism.

Along those lines of inquiry, this chapter will examine scientific writing to survey prose and poems by seventeenth-century Italian writers, as well as prior scientific and literary texts as cultural products of the Scientific Revolution. Through literary forms centering around concepts of innovation, imitation, and tradition, both scientists and scientific-oriented authors introduced new words and related ideas, as was the case for the telescope recently invented in 1609, called "cannocchiale" or "telescopio." Additionally, describing natural experiences ("experientia") helped to understand and replicate more general principles in scientific disciplines.[93] As humanism had innovated on classical ideals of rhetoric and terminology in the fourteenth and fifteenth centuries, scientific humanism innovated contents regarding the study of nature in Galileo's works. Elaborating on Calvino's claim that "[…] the classics are those books about which you usually hear people saying: 'I'm re-reading...,' never 'I'm reading...'", the Book of Nature metaphor refashioned by Galileo became an interpretive key for reading about nature as well as writing about it.[94]

Such literary tradition is clear in Galileo's powerful Book of Nature metaphor and imagery. Since imitation and innovation challenged new followers of his discoveries to write, and write well about science, his readers – scientists, but also poets – incorporated scientific concepts from the Book of Nature metaphor and adapted them for cultural, political, and personal purposes in an interconnectedness that built a spiritual, if not geographical and political, 'Republic of Letters.' "Philosophy is written in this grand book,

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[93] See Pierpaolo Antonello, *Letteratura come filosofia naturale: Italo Calvino e il menage a trois come programma letterario*. Stanford: Stanford University Press, 2002.

[94] "I classici sono quei libri di cui si sente dire di solito: 'Sto rileggendo' e mai 'Sto leggendo'..." (Italo Calvino, *Perché leggere i classici*, 1991, 11–19; English translation, 1999, 3–9).

the universe, which stands continually open to our gaze," Galileo wrote, and he added that "the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed" (*OG* VI, 232, trans. Drake 238). In Baroque strategic thinking, "finding truth is the first step to prepare oneself to speak about it," as Torquato Accetto wrote ("Bisogna dunque di volger gli occhi alla luce del vero prima di muovere la lingua alle parole," Accetto III). Thus, textual secrecy and dissimulation both protected and exposed new ideas, and the words to express them, in the right type of text, at the right time.[95] Anticipation and curiosity were part of a theatrical staging, in prose and poems, to reveal some of the ideas that Galileo shared in books and in letters addressing renowned scientists in Europe.

In the Book of Nature passage quoted above, Galileo appreciated both the components of a physical book, the characters of the print ("i caratteri") and the language in which it was written ("la lingua"). Concentrating on both aspects, Galileo's Book of Nature metaphor expressed a relevant verbal toolkit whose concepts would become easily memorable and influential. According to Accetto, indeed, the notions one expresses are related to the concept one has of his own knowledge (Accetto XVI).[96] Philosophical, artistic, and technological concepts would appear in the right textual and visual contexts to introduce new words for things and concepts that did not exist before.

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[95] See Mario Biagioli, "From Ciphers to Confidentiality: Secrecy, Openness and Priority in Science," *British Journal for the History of Science* 45.2 (2012): 213-33.

[96] "I concetti che risuonano nelle parole, non solo portano l'imagine di quelli che stanno nell'animo, ma son fratelli mentali (già che non posso dir carnali) del concetto che l'uomo ha del suo sapere. Questo è il concetto primogenito (per dir cosí), al qual succedono gli altri; e se non è con misura, ne procedono molti e vari ragionamenti, e di necessità però si scopre quanto è nel pensiero; ma chi di sé fa quella stima che di ragion conviene, non commette alla lingua maggior giuridizzione di quanto è il lume dell'intelligenzia che la dee muovere" (Accetto XVI).

In the Book of Nature metaphor, the book became one unit of meaning, an exemplary book whose contents are subject to change, as everything in nature is in constant transformation. The contents of the book, that is nature, were available to study through several scientific disciplines, from astronomy to physics, mathematics, and medicine in which human observers would study themselves as part of nature. Special characters expressed natural contents so that geometry and mathematics would provide the means for analysis, in which context fonts were a form of emblematic, visual elements that one would interpret through analogies to geometric units, and finally through the language of mathematics necessary to interpret the Book of Nature.[97] The leading Book of Nature metaphor, thus, can convey scientific meaning because metaphors connect two things that are distinct, as Tesauro acknowledged in his definition of rhetorical tropes (Tesauro 275-593). From such perspectives, examining nature as an immense source of information, is fundamental through correct methods of inquiry that Galileo explained in fictional terms as the scientific method.

As mentioned in the previous chapter, Galileo collaborated with readers and editors to publish his books, and he was a careful editor of his own drafts. Galileo was not only a self-edited author, but he also acted as an editor for professional literary authors who asked for his advice and approval. While Galileo accepted advice and support from Cesarini and Ciampoli, he also crafted his authorial persona through communicative campaigns such as cryptographic messages and anagrams, and an intended *manifesto* appeal addressed to Pope Urban VIII by the Accademia dei Lincei, in *The Assayer* (1623).[98] The context for the Book

[97] Kuhn commented extensively on theoretical priorities in science, the linguistic implications of original expressions, and translations as linguistic choices (Kuhn 200-03).

[98] Francesco Stelluti wrote a letter to Galileo (12 August 1623, *OG* XIII, 121-22) describing reactions of hope, optimism, and great expectations in Rome right after Urban VIII (Maffeo Barberini) had been elected

of Nature metaphor within debates on comets substantiates the original scientific method initiated in Galileo's works in Italian that scholars, friends, and respected correspondents in the Lyncean academy edited.[99] Furthermore, members of the Accademia dei Lincei were known for their scientific agenda and publications, and happily supported Galileo's books by editing them, whereas other friends validated Galileo's theories and reported on the publication and reception of his books. Tommaso Rinuccini, for example, commented that Father Grassi felt jealous because sponsors had funded the publication of *The Assayer*, and promised he would, unlike Galileo, not use sarcasm in his writing.[100] When Grassi, however, found out that some books were already on sale in Florence, he defended the Jesuits against any scientific and cultural attack, while remaining certain that they could successfully deal with one hundred heretics a year, and that one Catholic (that is, Galileo) would not be a problem.[101] Rinuccini equally reported to Galileo about reactions to Sarsi's book that Aristotelian supporters did not enjoy, while mentioning that some intellectuals, perhaps out of spite and envy, refused to read *The Assayer* at all (3 November 1623, *OG*

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as a new Pope just a few days earlier, on 6 August 1623. On the Inquisition trial, documents, and motives see Maurice Finocchiaro, *The Galileo Affair*. Berkeley: University of California Press, 1989.

[99] Virginio Cesarini wrote about editorial changes and quick errands related to Galileo's publications, with Ciampoli's help. In a letter from Rome (20 March 1623), Cesarini reassured Galileo about Prince Cesi's revision and the support of some academicians and Magalotti. As a result of such collective revision, minor aspects and a few words in *The Assayer* were edited. The book would then be printed and sold soon after: "Dopo l'havere havuta la censura (benché brevissima) dal S.r Principe Cesis [sic] intorno al *Saggiatore,* ed anco i pareri d'alcuni Accademici Lincei, era io restato d'appuntamento col S.r Filippo Magalotti, molto partiale amico di V.S., d'essere insieme a dare una trascorsa all'opera e cambiare et emmendare quelle poche parole, che àn consigliato i detti che si mutino… La mutazione non è di cosa sustanziale, e solo l'accomodamento d'alcuni vocaboli. Giovedì si porrà l'opera sotto il torchio, et con velocità si tirerà avanti" (*OG* XIII, 111).

[100] "[…] disse ben di voler replicare senza mordacità (chè di questo si lamentava di lei), e che se V. S. veniva a Roma, voleva far seco amicizia."

[101] "[…] doverebbe haver chiuso la bocca a tutti i Gesuiti, che non saprebbono che si rispondere . . ."; "seguitò il Sarsi con questa sciocchezza, che se i Gesuiti sapevano in capo a l'anno rispondere a cento eretici, saprebbono anche farlo a un cattolico."

XII, 145). The Jesuits, however, would not be free to discuss those scientific texts, including the ones by Galileo.[102]

The 1623 book by Galileo, though, was beyond any suspicions as it had been reviewed by Niccolò Riccardi, a person of great culture.[103] The text was theologically sound, and Rinuccini also wrote about Father Ciampoli reading several passages from *The Assayer* to the Pope, who enjoyed the fable on the origin of sounds.[104] That fictional narrative generated great interest in readers. At the same time, it also alluded to the author's own quest for knowledge, as Galileo subtly narrated the adventures of a man exploring how sounds are produced in nature. In that fictional story that is atemporal, Galileo used a literary mask to portray his faith in continuous scientific research through a fictional character, in a form of dissimulation, for a quest moving from unknown principles to conscious, unending intellectual curiosity (Propp, *Morphology* 35, 78, and 95). The fable on sounds shows one possible path towards knowledge, where one might get lost and go back to the starting point (Baffetti 504). That passage fascinated poet Marino's imagination, too, leading him to "narrate a pleasant story about that truly marvelous singing" in a poetical rendition that mirrors, and pays homage to, Galileo's fable on the origin of sounds.

Such personal secrecy appears also in Marino's poem *Adone* whose namesake character speaks "in verse, so that, in a way, he tells his own story by sharing anecdotes

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[102] "[…] stamattina ho sentito dire da un Gesuito che fra loro c'è severo comandamento di non discorrere di queste scritture" (2 December 1623, *OG* XIII, 154).

[103] "Padre Mostro Domenicano, persona di non ordinario sapere . . . revisore del suo *Saggiatore*" (*OG* XIII, 145-46). Father Riccardi wrote his reports from Collegio di S. Tommaso sopra la Minerva in Roma, the same place where Galileo's trial and recanting would take place ten years later, on 22 June 1633.

[104] "Mons.r Ciampoli m'ha detto d'haverne letti più pezzi al Papa, e particolarmente la favola del sono, e che li gusta sommamente ogni cosa."

about others."[105] Imagination and creativity can, then, compensate for the lack of an objective understanding: "gli umani ingegni, quando più non sanno, / favole tali ad inventar si danno" (*OG* VI, 2, 7-8). Socratic claims remind wise observers to be modest and wise, as "the one who knows quite a bit and believes he does not know" (*Adone* VI, 47, 7-8). If intellectual humility is a value, as Galileo believed, people should be cautious or, as Accetto argued, use a "compass for self-esteem" and search for models and mentors elsewhere to prevent any self-referentiality, in order to avoid the same mistakes.[106]

Such thinking process in terms of science and method is visible in Galileo's writings and the authors he inspired. Galileo intended his scientific contents, for example the description of Jupiter's satellites, the phases of Venus, and the telescope to be descriptive, amusing, and entertaining texts.[107] Material evidence to his reading and writing practices is found in his frequent annotations on books he owned, for example the poems by Petrarca and epic poems by Ariosto and Tasso.[108] A close friend of Galileo, Gian Vincenzo Pinelli, had a very famous library, situated just a few blocks away from Galileo's home in Padua, and later lost in a shipwreck (*OG* XVI, 28, 170). Documentary evidence for books, letters, and references to Galileo have been collected, dated, transcribed, and published by Antonio Favaro in the monumental twenty-volume critical edition that is still the reference collection of Galileo's works (1890-1909).[109]

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[105] On the value of examples in Marino's poem, see "Di quel canto nel ver miracoloso / una istoria narrar bella ti voglio" (Marino, *Adone* VII, 40, 1-2); "e i versi espone in guisa tal, che quasi / sotto gli esempi altrui narra i suoi casi" (*Adone* VI, 47, 7-8).

[106] "L'error che si può far nel compasso, il qual si gira nell'opinion di noi stessi, suol esser cagion che trabocchi ciò che si dee ritener ne' termini del petto" (Accetto XVI).

[107] See Fernand Hallyn, ed. *Metaphor and Analogy in the Sciences*. Springer Science: Dordrecht, 2000.

[108] For example, Galileo corrected typographic errors based on meter, rhythm, literary coherence, and he wrote literary and historical comments.

[109] Favaro collected any document he retrieved, including fragments, sketches, and calculations ("frammenti… racchiudenti di quei pensieri staccati che Galileo andava frequentemente notando qua e là fra le sue carte, o che almeno non hanno diretta attinenza con veruna delle scritture scientifiche di Galileo… Da

From the perspective of stylistic analysis and authorial crafting, Galileo discussed not only research, correspondence with colleagues and patrons, and publishing, but also the process of polishing, refining, and editing his works, and releasing controlled information in his letters while keeping in mind both audiences and politics of communication. Galileo himself revised his texts after publication, too, which I found to be a surprising ongoing process when I consulted the only annotated copy of his 1632 *Dialogue* (Codex 352, Biblioteca del Seminario Vescovile, Padua).[110] The book found its way to Padua after Cosimo Galilei, Galileo's grandson, brought the book with him, when he worked as a secretary to Cardinal Gregorio Barbarigo. In Galileo's annotated copy of the controversial book, his handwritten editorial notes and corrections document his revisions of the text, as well as his frustration against censorship.[111] Often the comments are edited to correct errors, or to rephrase passages in a subtler way.[112]

Such thorough revisions were frequent in Galileo's letters, too. Alison Abbott has recently announced the discovery of an unpublished letter by Galileo, dated 21 October 1613, that was in fact written two months later, on 21 December 1613, to present stronger

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parte nostra abbiamo tenuto conto di tutto ciò che, per ritenere comecchessia alcuna traccia del pensiero dell'Autore, avesse anche la minima importanza; e crediamo poter esser piuttosto rimproverati di aver voluto troppo conservare, che non dell'aver fatto getto di cose le quali meritassero d'essere raccolte"; *OG* VIII, 37).

[110] I am very thankful for the privilege of viewing and studying Galileo's private copy. Here, I wish to express my gratitude to the Biblioteca del Seminario Vescovile di Padova, Father Riccardo Battocchio who directed the library, and librarian Ms. Giovanna Bergantino. Without their help, I would have missed the experience of reading handwritten notes that Galileo left on blank leaves and on page margins of his own personal copy of the *Dialogue*, printed in Florence in 1632.

[111] Antonio Favaro, *Le aggiunte autografe di Galileo al* Dialogo sopra i due massimi sistemi*: nell' esemplare posseduto dalla Biblioteca del Seminario di Padova*. Modena: Società tipografica, 1880.

[112] Handwritten notes by Galileo appear in five endpaper pages before the first day of the dialogue, then two unnumbered pages between 98 and 99, and five unnumbered pages between 408 and 409. Specific textual comments are found at page 10; 12; 13; 16; 21; 22-23; 25; 39; 64; 72; 74; 92; 106; 116; 118; 121; 154; 156; 165; 184; 186; 188; 191; 193; 196; 198; 203; 209; 214; 240; 243; 249; 255; 266; 284-285; 288-89; 291-92; 314-15; 323; 325; 330; 335-36; 343-44; 351-52; 354; 356; 362; 364; 387; 390-91; 400; 406; 410-14; 416; 420; 422-23; 426; 428-29; 436; 439; 442; 455-56. More handwritten notes are present also in the section of *Errata* (I).

arguments in support of Copernican ideas.[113] When Galileo wrote to Benedetto Castelli the original 1613 letter that sparked so many astronomical controversies on what is in the Book of Nature and the Bible, Galileo made two different copies of that letter, and the safer version was transcribed and circulated independently for a wider audience (Abbott 441-42). According to Abbott, the letter "provides the strongest evidence yet that, at the start of his battle with the religious authorities, Galileo actively engaged in damage control and tried to spread a toned-down version of his claims" (Abbott 441). Such difficult circumstances induced Galileo to reframe his own theories originally criticizing the Church's doctrine that the Sun orbits the Earth. As a result of Galileo's two copies of the letter to Father Castelli, we now have two versions containing different information for different readerships.

One version safely edited for the Inquisition at Rome circulated in more than a dozen copies, still extant in different collections today. The other version, of which a single copy survives, was intended for a less permissive readership.[114] In that letter, Galileo substituted ambiguous words with politically correct ones. While, according to the original phrasing, certain propositions in the Bible might sound "false if one goes by the literal meaning of the words," in the revised version Galileo replaced the word "false" by crossing it out, and he wrote, instead, "looking different from the truth." He also did not refer to the Scriptures as "concealing" its most basic dogmas, using the term "veiling," instead, a point

[113] Alison Abbott, "Discovery of Galileo's Long-Lost Letter Shows He Edited His Heretical Ideas to Fool the Inquisition," *Nature News* (21 September 2018), online. The letter discussed by Abbott was found at the Royal Society in 2018.

[114] See also Michele Camerota, Franco Giudice, and Salvatore Ricciardo, "The Reappearance of Galileo's Original Letter to Benedetto Castelli." *Notes and Records of the Royal Society* 73 (2019): 11-28.

which supports my reading of Galileo's scientific writing as a practice of simulation and dissimulation compliant with Torquato Accetto's advice for Baroque strategies.

Philological attention to editorial notes in that letter has profound implications in this case. The stronger, more authentic astronomical message preserved in the letter at the Royal Society library is one of the cases in which "Galileo did the editing, it seems" to update and control the circulation of his own works as "mixed messages" (Abbott 441). The politically-correct version of that letter, instead, is extant in several copies, and one recent finding at the Vatican Secret Archives was meant for the Inquisition. In November 1612, Dominican friar Lorini had spoken against Galileo and Copernicus, stating that the doctrine of Copernicus violated the Holy Scriptures. Lorini's familiarity with Copernican concepts and Galileo's endorsement of those astronomical ideas might have been no more than superficial, since he referred to the Polish astronomer calling him "Ipernico." In 1614, following the attack against Galileo by Tommaso Caccini, Lorini sent a copy of the Letter to Benedetto Castelli to Cardinal Paolo Camillo Sfondrati of the Congregation of the Index. Father Castelli had returned the famous 1613 letter to Galileo himself, but on 16 February 1615 Galileo contacted Piero Dini and voiced concerns that Lorini's version was not only interpolated, but the one that the Inquisition had available. In order to compensate for that possible misunderstanding, Galileo thus attached a less controversial version of that letter to Dini, asking his friend to forward it to theologians in Rome. Next, I will discuss the literary and textual contexts of what Galileo said openly, subtly, and secretly, both in published works and in his correspondence. When, how, and why did he communicate scientific ideas in traditional, but also in less than conventional humanistic modes?

3. Reading Natural Experiences through Scientific Methods.

In addition to established humanistic traditions grounded in rhetoric, style, and genres, Galileo was fascinated with the combinatory possibilities across languages and within language itself, thus switching between Latin and Italian, and occasionally the dialect spoken in Padua, where he worked from 1592 to 1610. Occasionally, he also enjoyed coded communication in anagrams and riddles circulated in his letters.[115] Unconventional scientific narrations soon developed alongside the scientific genre in Latin, with the first sci-fi work, *Somnium* (*Dream*), written by Johannes Kepler in Latin in 1608, which Ludwig Kepler only published in 1634 after his father's death.[116] Kepler's book recounts the trip of an Icelander to the Moon, all the while expressing concerns on magic, witchcraft, and power dynamics enabling witchcraft trials. Within that literary frame, one might wonder whether Kepler, famous and respected as the Imperial Astronomer, felt compelled to think more about the natural and supernatural world as connected entities, as he prepared to conduct his mother Katherina's defense for a long trial that started in 1615.[117]

While Galileo's communicated his "scientific revolution" through linguistic revolutions, his Latin and Italian books were also translated to make them accessible to Italian and European readers, respectively. The *Sidereus Nuncius*, originally in Latin

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[115] One of the earliest references is the letter sent by Giovanni Uguccioni to Belisario Vinta on 21 September 1592: "Sono in Padova, e sono venutoci con Mess. Galileo Galilei, che legge la Matematica in Pisa; quale quindici giorni fa venne per vedere Venetia, et in tanto hieri in carrozza, in discorrendo meco, mi disse che in Venetia era stato ricerco di leggere in Padova, e che crede che harebbe 200 scudi in circa di salario l'anno"; *OG* X, 49).

[116] Kepler, Johannes, and Ludwig Kepler. *Ioh. Keppleri mathematici olim imperatorii Somnivm, seu opvs posthvmvm De astronomia lunari. Impressum partim Sagani Silesiorum, abdsolutum Francofurti, sumptibus hæredum authoris*, 1634. Retrieved from the Library of Congress, www.loc.gov / item / 39010144.

[117] Ulinka Rublack, *The Astronomer and the Witch. Johannes Kepler's Fight for His Mother*. Oxford: Oxford University Press, 2015.

(1610), was translated into Italian by Vincenzio Viviani, many years after Galileo had planned to publish a version of the short treatise in "toscano."[118] An academic rival like Jesuit Orazio Grassi would buy *The Assayer* from the publisher the very first day the book became available, and he promised a response within three months, and naturally for a Jesuit that response would be in Latin.[119] The revolutionary *Dialogo* (1632), written by Galileo in Italian, generated lively European discussions soon after its publication and subsequent ban, thanks to a Latin translation titled *Systema cosmicum* by Matthias Bernegger (1635). Bernegger, a professor at Strasbourg, had been hired by science enthusiast Elias Diodati, so he translated the work and also cautiously wrote a prefatory note addressing the "Kind Reader." In his preface, he lists his reasons for publishing a translation and a new edition of the *Dialogue*, claiming that the new version had been published without Galileo's knowledge or consent. Such claim was not true, but it was intended to protect the author from restrictions on publishing and possible persecutions.[120]

As scientific wonder and novelty captured readers in Europe, authors such as Galileo and those who admired his enterprises adapted and integrated traditional forms of narrative discourse to introduce new contents into conventional modes of prose and poetry. The idea of writing (and reading) the Book of Nature became a common reference for

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[118] Galileo was still in Padua, so the editorial plan pre-dates July 1610, when he moved back to Tuscany to work under the Medici patronage. See Mario Biagioli, "Galileo the Emblem Maker." *Isis* Vol. 81, No. 2 (1990): 230-58.

[119] "Finalmente, doppo un lungo aspettare, si publicò il *Saggiatore*, riceuto da i servitori veri di V. S. con estremo contento; e molti andiamo spiando di ritrovare con qual toleranza d'animo sia visto e letto da quelli per i quali è particolarmente scritto, o, per dir meglio, ch'hanno dato materia di scrivere: e di tutto quello che si ritroverà, V.S. sarà ragguagliato. Intanto le posso dire che il primo dì il Padre Grassi fu [col] libraio che gli vende, e se ne fece dare uno, dicendo che V. S. l'haveva fatto stentare tre anni, ma che lui in tre mesi la voleva cavar di fastidio: non so poi come li basterà l'animo di mantener la parola" (letter byTommaso Rinuccini, *OG* XIII, 145).

[120] Regarding the dialogue *On the Two New Sciences*, Favaro reconstructs transactions with printers and the selection of Elzevier as the printer, with Micanzio's mediation (*OG* VIII, 16). A copy of *Systema cosmicum* is at Rutgers Special Collections and University Archives. On the genesis of the book, see Renee Raphael, *Reading Galileo: Scribal Technologies and the Two New Sciences*. Johns Hopkins University, 2017.

authors at the time of Galileo, as we will see through the incorporation of the metaphor and its elements in Italian prose and poetry. In English, Galileo's influence may be seen, for example, in *Paradise Lost* by Milton, a book in which only two authors are mentioned: Galileo, in three occurrences, and Ariosto, who was Galileo's favorite Italian author. In the opening to his poem, Milton wanted to win his readers' approval for textual novelties, and his words "[…] things unattempted yet in Prose or Rhime" (*Paradise Lost* 1, 16) translated an early line in the poem by Ariosto ("cosa non detta in prosa mai né in rima" *Orlando Furioso* I, 2, 2) to introduce a rhetorical 'captatio benevolentiae.'[121]

On a structural level, Galileo used language and style in a versatile way to express scientific ideas through treatises and also books with fictional frames, as in *Dialogo* (Day One and Two) where he proposed an alternative cosmological system regarding the positions and motions of the Earth and Sun. While the dialogue was meant to convey scientific discussions, through personalized opinions voiced by the characters of Salviati, Sagredo, and Simplicius, the author's personal connection to Salviati and Sagredo made those characters more connected to their innovative and curious experiences of nature. For Simplicius, instead, the support of Aristotelian theories and some lines rephrasing what Cardinal Maffeo Barberini had said, made that fictional presence problematic, and a key theme leading to the 1633 Inquisition trial.

In the *Dialogue*, Giovanfrancesco Sagredo is one notable example of fictional representations of science enthusiasm, because he was a close friend of Galileo's, but also a correspondent writing from Venice and the family properties in Veneto and adjacent

[121] For the cultural, if not factual, encounter between Galileo and Milton, see William R. Shea, "Galileo and Milton," *Galilaeana* XIII (2016): 1-27.

regions, and from his political posts in Palmanova, Aleppo, and Morocco.[122] Thanks to his international connections, Sagredo managed to collect and compare scientific data, such as times at various longitudes (*OG* XI, 524-25). Once Sagredo returned to Venice, however, Galileo had already left his position at the University of Padua and moved to Florence in 1610. After that time, the two friends wrote letters, and they exchanged portraits in June 1619.[8] They never met again, but their friendship also inspired Galileo to choose Venice as a background, and Sagredo as a leading character in two of Galileo's books (*Dialogo*, 1632, and *Discorsi*, 1638).

While scholars have long noted new scientific discoveries with newly invented instruments, such as the telescope and the microscope, the introduction of innovative words and phrases as scientific neologisms is a major component of a Scientific Revolution that, in Italy, prompts investigations in non-traditional linguistic media and as non-Tuscan Italian vernaculars, as the Paduan dialect in one of Galileo's works on astronomy.[6] In his book on the geography and history of Italian literature, Carlo Dionisotti found those to be connected aspects of literary history which he associated as "the geography and history of Italian literature." Dionisotti discussed Italian authors as intellectuals equally connected to their hometowns and to current historical and political circumstances, and he suggested that introducing Italian literature solely from historical viewpoints had likely made Tuscan literature become *the* literature of Italy in a seemingly unifying cultural project of language and geography (Dionisotti 1967, 23-45; 45-73). He noted, though, that two foundational authors, Dante and Petrarca, wrote their major works while away from Tuscany (34). Since

[122] Sagredo's portrait, currently in the Ashmolean Museum, used to be in Galileo's rooms while he wrote the *Dialogue* (1632) and the *Two New Sciences* (1638), both of which works cast Sagredo as a leading character. The *Dialogue* is set in Sagredo's house, currently known as the Morosini-Sagredo Palace in Venice (Wilding 6-19).

scientific texts are not usually included in the Italian literary canon, Dionisotti mentioned Galileo only briefly, though, in the social contexts of clergymen and laypeople (71-72). Such geographic and historical perspectives have been updated since then, for example through digital humanities studies highlighting Galileo's library, as well as his humanistic and scientific education (Hall 2019). In this study of scientific texts, I have expanded traditional literary perspectives into the contexts of letter writing in the Italian vernacular, in Italy and abroad, to introduce themes of Italian diaspora in the early modern period for scientific topics (Gabaccia 16).[123] Consequently, interpretations of experimental texts and unusual correspondence show the growing importance of Italian vernaculars as plural linguistic expressions worthy of official academic discussions.

In terms of innovative contents, neologisms were coined for new scientific instruments whose discussion was influential to promote the scientist's research, since observation only depended on the view of celestial bodies through a tube and lenses (Bucciantini, Camerota, and Giudice 2015, 118; 146). The response was both theoretical and practical, with Galileo explaining what the telescope allowed one to see, in observations recorded in his books, but also through public demonstrations of the telescope through his friends, as Esau del Borgo did at the Spanish court. Del Borgo wrote that he needed new lenses (13 May 1631; *OG* XIV, 260), but he was also aware that there might be shipping delays because of the current plague. Another supporter in that international effort to promote the telescope was Caterina Riccardi Niccolini, the wife of the ambassador

[123] I have developed a mapping project through digital humanities tools, to trace people who wrote to Galileo on topics of astronomy before and after the 1633 Inquisition trial respectively. I have discussed letters, correspondents, and mapping visualizations in a dossier narrative and forthcoming book chapter titled "Dear Galileo: Letters on Astronomy" in the *New Technologies in Medieval and Renaissance Studies* series, general editors William R. Bowen and Raymond G. Siemens, volume editors Randa El Khatib and Caroline Winter. Toronto: Iter Press, 2021.

of Florence, who reassured Galileo that they had sent a telescope to replace the one Esau had, but the item was returned to Florence because of plague safety checkpoints at the borders, and when her mother-in-law received the returned package, she did not feel it was safe to accept any shipped goods (1 November 1631; *OG* XIV, 305).

Galileo's correspondence is a source of information and science in progress that is unparalleled in texts written by him. In my survey of Galileo's collected works, I have found ten volumes of letters of Favaro's edition in which I ascertained that there were 370 correspondents who wrote letters to Galileo on topics of science. Some correspondents had never met Galileo in person, while others were introduced by common friends in a letter, for example Cardinal Maffeo Barberini, who would later become Pope Urban VIII (5 July 1619, *OG* XII, 463). Barberini's case is significant as an example of a person shifting opinions from approval to condemnation of Galileo's theories, to the point that he started the Inquisition trial a few months after Galileo had published the *Dialogue* (1632), that the Pope found controversial.

Galileo's correspondents were scholars, friends, and former students who had become mathematicians, astronomers, or physicians, but also diplomats and secretaries writing on behalf of Galileo's patrons at the Republic of Venice, and later the Medici court. Other important correspondents were the Jesuits, leading mathematicians and theologians in the early modern period, who exerted their cultural and scientific influence throughout Europe, as Shea and Artigas have shown (Shea and Artigas 2005: 1-18). For Galileo, it was important to keep professional connections with renowned scholars, such as the Imperial Astronomer, Johannes Kepler, and Jesuit scholars in Italy and Europe, all of whom

constituted a professional and scientific network to discuss science.[124] For example, Galileo admired Copernicus and honored his memory, but he mostly ignored the prominent astronomer Tycho Brahe, whose theory reconciled both Ptolemaic and Copernican ideas, and only wrote one letter to Galileo (writing from Benátky nad Jizerou, in the Central Bohemian Region of the Czech Republic, 4 May 1600, *OG* X, 79-80). Among those correspondents, eleven were women: Galileo's daughter Maria Celeste, artists Artemisia Gentileschi and Anna Maria Vaiani, author Margherita Sarrocchi, friends Petronilla Bartolini, Alessandra Buonamici Bocchineri, Ortensia Guadagni Salviati, Maria Tedaldi, Lodovica Vinta, Virginia Landucci, and Caterina Riccardi Niccolini. Galileo's correspondents discussed ideas and publishing plans, but Galileo's activity as an editor of his own works demonstrates his compositional and critical sophistication and his willingness to communicate with others.[125] His advice as a reader and writer was appreciated and writers would contact to read and revise their own texts.[126] By curating his writing, discoveries, and personal branding, Galileo reinforced humanistic and Renaissance ideals of the polymath who was not only an expert in nature, but also a teacher, a musician, and a respected authority. Such literary awareness, as a matter of fact, completed his public image as a humanist and as an ambitious natural philosopher, the title

[124] The *Republic of Letters* project by Paula Findlen and Hannah Marcus at Stanford University has examined "the surviving correspondence of the mathematician and astronomer Galileo Galilei… to map his social and intellectual networks" (Findlen and Sutherland 2020; http://republicofletters.stanford.edu).

[125] He saved notes from a young age. Without intending to make a book out of those notes, he still shared them with correspondents as needed ("Manderò quanto prima questo trattato de' proietti, con una appendice d'alcune dimostrazioni di certe conclusioni de centro gravitatis solidorum, trovate da me essendo d'età di 22 anni e di 2 anni di studio di geometria, le quali è bene che non si perdino," in a letter dated 6 December 1636 Mss. Gal., Par. V T. VI, car. 85r).

[126] Outside of the strictly scientific production, Galileo authored a "capitolo bernesco" protesting against academic gowns, but also lectures on Dante's *Comedy*, a comedy draft, and some poems. Furthermore, Galileo received letters from poets asking for his literary advice (for example, he edited a poem by Andrea Salvadori, in *OG* IX, 227), and recommended books to read. Cfr. Tibor Wlassics, *Galileo critico letterario* 44-49; 92-94; 94-98; 152-54.

he eventually attached to his name on book frontispieces for books that he truly cared for deeply: "filosofo e matematico primario" for *Il Saggiatore* (1623), but also the *Dialogo sopra i due massimi sistemi del mondo* (1632).

A mathematician with strong interests in the study of nature, Galileo became involved in astronomical studies when, on 9 October 1604, a new star was first seen in the sky throughout Europe. That star, now known as Kepler's Supernova, appeared in the sky, and it was visible in Europe and parts of Asia. Many Aristotelian philosophers wanted to explain what the new star (or "nova") was and how it moved near the conjunction of Jupiter and Mars in Sagittarius. Galileo had assumed a pseudonym to discuss astronomical topics safely, writing under Mario Guiducci's name. The debate began when the philosopher Lodovico delle Colombe claimed that the star was not new. Galileo was interested, too, so he engaged in his first study of astronomy, giving three public lectures where he discussed the measurement of distance and parallax and tried to refute the Aristotelian theory that nova stars were sublunar phenomena.[127]

Galileo's response to this debate was a curious dialogue written in the Paduan dialect, titled *Dialogo de Cecco di Ronchitti da Bruzene. In perpuosito de la stella nuova*

[127] Philosophy professor Cesare Cremonini, a personal friend of Galileo's, but an academic rival, and philosopher Antonio Lorenzini opposed Galileo's explanations. Debates on classical languages, Tuscan, and other vernaculars had been discussed in Speroni's *Dialogue on Languages*, one character, Perotti, stated that classical languages remove us from first-hand experience of nature, as relics; he also anticipated a day in which communication will be released of linguistic concerns ("chi vorrà parlar di philosophia con parole Mantovane, o Milanesi; non gli può esser disdetto a ragione . . . perché il mondo non ha in costume di parlar di philosophia se non greco o latino; già crediamo che far non possa altamente: et quindi viene che solamente di cose… volgari volgarmente parla, et scrive la nostra età. Et come i corpi, et le reliquie de santi non con le mani, ma con alcuna verghetta per riverenza tocchiamo; cosí i sacri misteri della divina philosophia più tosto co[n] lettere dell'altrui lingue, che con la viva voce di questa nostra moderna, ci moviamo a significare: il quale errore conosciuto da molti, non ardisce di ripigliarlo. Ma tempo forse pochi anni appresso verrà che alcuna buona persona non meno ardita, che ingegnosa, porterà mano a cosí fatto mercatanti: et per giocare alla gente, non curando dell'odio, né della invidia de letterati, condurrà d'altrui lingua alla nostra le gioie, et i frutti delle scientie; le quali hora perfettamente non gustiamo, né conosciamo"; *Dialogo delle lingue* 114-15).

(Padua: Pietro Paulo Tozzi, 1605), a discussion between peasants Matteo and Natale in their native tongue ("Pavan).[128] The book is a pseudonymous pamphlet of some thirty-six pages, claiming to report discussions of two men from Brugine, a town situated between Padua and Venice.[129] Because a new star, in 1604, appeared in European skies, people started worrying.[130] Galileo addressed those concerns in a language that was not his own native Tuscan vernacular, but one that he learned in his time in Padua (1592-1610).[131]

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[128] The short book, written in the form of a dialogue, was once attributed to Girolamo Spinelli, but it is now believed to be the work of Galilei (Stillman Drake, *Galileo against the Philosophers* 25, 134). All quotations are from unnumbered pages in the first printed edition. Galileo was known to speak the Paduan dialect, as fan mail in Pavan is extant, for example when Giuseppe Gagliardi had written to Galileo (March 1608). For more details on the Pavan book, see Antonio Favaro, "Galileo Galilei ed il *Dialogo de Cecco di Ronchitti da Bruzene in perpuosito de la Stella Nuova*," *Atti del Reale Istituto Veneto di scienze, lettere ed arti*, vol. 7, ser. 5 (1881): 195–276.

[129] The short dialogue opens with a dedication to Antonio Querenghi (Motta 176): "To the illustrious, revered Sir Antonio Querenghi, the Canon of Padua. With some *ottava* rime by an anonymous author, about the same star, against Aristotle" ("Al Lostrio e Rebelendo Segnor Antuogno Squerengo degnetissemo Calonego de Pava, sò Paròn. Con alcune ottave d'Incerto, per la medesima Stella, contra Aristotele"). On the writer to whom Galileo dedicated his book, see Uberto Motta, *Antonio Quarenghi (1546-1633). Un letterato padovano nella Roma del tardo Rinascimento*. Vita e pensiero: Milano, 1997, in particular the chapter "Scienza e poesia nella cerchia dei galileiani di Padova," 151-216. Though everyone knew who the name alluded to, "rimaneva l'unico, minimo elemento storicamente consistente dentro la finzione del frontespizio; esso poteva apparire come *senhal*, a indicare subito sia di dove provenisse l'intervento, sia chi, sul mobile scenario della vita cittadina, se ne fosse fatto principale patrocinatore" (Motta 176). The Venetian dialect was the spoken language in Padua, one of the territories annexed in 1405, with some local variations.

[130] Stillman Drake and Charles Donald O'Malley, eds. and trans. *The Controversy on the Comets of 1619*. Philadelphia: University of Pennsylvania Press, 1960. Traditionally, comets were thought to anticipate tragic changes in history, a belief that Galileo mentioned at the opening of *Sidereus Nuncius*, where he referred to Caesar's and Augustus's comets. The quick, sudden apparition of a comet was a reason of concern as an omen for those who saw it in the sky, or heard news about it (*Adone* III, 3, 7-8). Comets were quick, bright, sudden appearances, and those features were showing in metaphors for quick, sudded human motions, too: "as a comet" ("or qual cometa" *Adone* VIII, 79, 3); "I looked like, running quick, / a falling star of a flying lightning" ("parvi, battendo le veloci piante, / stella cadente o folgore volante" *Adone* IV, 279, 7-8).

[131] Stillman Drake, *Essays on Galileo and the History and Philosophy of Science*, Volume 1, ed. N.N. Swerdlow and T.H. Levere. A famous example of an author struggling to choose one language among several in which they are fluent, for example, is Arthur Koestler who mentioned inner conflicts in his autobiography, when he had ambivalent feelings for German, the language of his education, and the newly acquired English language. Koestler had lost track of some articles he had written in German and found, much later, that he "had for more than ten years written and thought in English." As a result, Koestler felt displaced: "This is probably a common action among writers who have a stronger relationship to their work than to their ego. But the commonness of an experience makes it no less painful. In my particular case, the effect was increased by a contrast in languages" (Koestler 225). Writing about science in several languages was Galileo's experience (Latin, the Tuscan vernacular, that is Italian, and the Paduan dialect), as well as Koestler's (German, Hebrew, English). The decision to experiment with more languages, for various reasons, and the preference for one language eventually, were part of Koestler's reflections in his autobiography: "I would bridge the gap between science and the people. A score of magazines and newspapers were at my disposal as channels of enlightenment. There was a mission waiting for me; gradually I would shift the emphasis in

Familiarity with other areas and their local traditions helped one to dissimulate ("Da chi ha per non plus ultra le porte delle natie contrade, o che da' libri non apprende il lungo e 'l lato del mondo, e' suoi vari costumi, con difficultà si viene al consiglio della dissimulazione" Accetto VII). The Paduan dialect, thus, became a tool to translate and popularize contents, though there is no agreement in the scholarly debate regarding a more popular audience, or a high-end readership.[132] The case for Sperone's theory on languages validates Galileo's use of a non-Tuscan dialect.[133] The two peasants discuss the new star, in Galileo's dialogue, stating that the ongoing academic debating ("per via de desbuta") sounds hilarious to them, regardless of the professorial gowns those scholars wore to look like proper academics (311).[134]

First, the two fictional characters wanted to ascertain if scholars from Padua University were involved in the astronomical dispute on the 1604 nova, mentioning their "friend from the Bo tower" that is, the main palace at Padua University ("me' frelo de la tor dal Bo'?").[135] After that first metatheatrical hint of the author to his readership, Matthio,

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popular education from stale humanities to a lively comprehension of the mysteries of the universe and life. If I could not catch the arrow in its flight, at least I could impress its flashing image on the minds of people, and make them conscious of its message: the eternal and the infinite" (Arthur Koestler, *Arrow in the Blue. The First Volume of an Autobiography: 1905-31*: 284).

[132] Archivio digitale veneto, Biblioteca online dei testi veneti dalle origini al secolo XVII secolo, hosted by Padua University (http://www.ilpavano.it/?page_id=36).

[133] Perotti maintained that reading Aristotle would be easier, once the text is translated into the vernacular ("le speculazioni del nostro Aristotile ci diverrebbono più famigliari, che non son hora; et più facilmente sarebbero intese da noi, se di Greco in volgare alcuno dotto uomo le riducesse"). See Teodoro Katinis, *Latin and Vernacular Interplay: Lazzaro Bonamico as Author and Character of Sperone Speroni's* Dialogo delle lingue, *Neo-Latin and The Vernaculars: Bilingual Interactions in The Early Modern Period*. In *Medieval and Renaissance Authors and Texts* 20 (2019): 36-52. On the value of dialogue as a genre, see Virginia Cox, *The Renaissance Dialogue*. Cambridge: Cambridge University Press, 1998, and David Marsh, *The Quattrocento Dialogue: Classical Tradition and Humanist Innovation.* Cambridge, MA; London: Harvard University Press, 1980.

[134] That line from the peasants' dialogue is an ironic reference to Galileo's *Contro il portare la toga*, a "capitolo bernesco."

[135] "Bo", the Paduan word for "calf," is the emblem for Padua University. The name was coined in the thirteenth century, when most classes were in the main building of the school, in what used to be a hotel and, earlier, a butcher's store that had a calf sign at the entrance. To this day, "Bo" is synonymous with Padua University.

however, confesses he had always been fascinated with astronomical observations, so that the current, global wonder for the nova star only rekindles his old astronomical interests.[136] The desire to observe the sky is "natural," which in Paduan is "snatural," an adjective that became popular with the vernacular writer Ruzante (Angelo Beolco).[137] The novelty of the star is "the reason of so many wonders," but also a carrier of weather changes and droughts.[138] Natale recalls wonder as the first motive for their conversation, asking if Mattio has seen "that star that has been shining in the evenings in the last three months, and looks like an owl's eye, even in the mornings, shining so beautifully, when we get up early to go prune trees." The two farmers discuss, then, whether a surveyor ("pertegaore") wrote the recent book to explain the new star. Disappointed to hear that the author is a philosopher ("Filuorico"), they maintain that philosophy does not have anything to do with measuring. One should, instead, trust mathematicians who measure things abstractly, as farmers measure their fields in real life ("L'è filuorico? C'ha da fare la sò filuoria col mesurare? . . . El besogna creer a gi smetamatichi, que gi è pertegaore de l'aire, segondo, che an mi a pertego le ca[m]pagne").[139] Using philosophy and Aristotle's authority to

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[136] "[…] inchinda da tosatto, el me tirava el me snaturale a guardare in elto, e si a g'haea gran piasere desfeguranto la boara, le falce, i biron, la chiocca, e 'l carro, con tutto; mo gnan per questo a no ghe n'harae sapio faellare, s'a no v'haesse sentù vù mille, e millianta botte a dire mo na consa, mò n'altra a sto perpuosito. E si de sta Stella nuova, que dà tanta smeravegia a tutto el roesso mondo; per conto de dire on la sea, a ghe n'hì, per muò de dire, fatto lotomia; faellanto, e desbutanto cò quanti disea, che la n'iera in Cielo; que se ben a no ve n'adavi, mendecao a me ve cazzava in le coste mi, e si a ve sentia, e si (se miga a n'hò un celibrio spelucativo, com'hà de gi altri) a tegnia mente a zò cha disivi" (*Dialogo de Cecco di Ronchitti da Bruzene* 311-12).

[137] See Marvin Carlson, *Speaking in Tongues: Languages at Play in the Theatre*. Ann Arbor: University of Michigan Press, 2006.

[138] "Mo n'heto vezù quella Stella, che sberlusea la sera zà tri misi, que la parea n'ogio de zoetta? e si adesso la se vè la mattina con se và a bruscare, que la fà on spianzore beletissemo? no t'acuorzito, che la xè vegnua da fresco? (. . .) mo l'è ella cason de ste smeravegie, e de sti sicchi, segondo, che dise on dottore da Pava" (*Dialogo de Cecco di Ronchitti da Bruzene* 314). Uppercase and lowercase are followed here from the original dialogue as it was printed at Galileo's time.

[139] Measuring with a rod ("pertica" in standard Italian) is a recurrent theme in the dialogue, with the purpose to make geometry, measuring, and surveying more approachable for readers from diverse backgrounds. A rod is a simple tool that makes geometry more accessible to understand, as shown in Marino's personification of Geometry, by drawing geometrical shapes with it (*Adone* X, 125, 1-4).

understand astronomy seems unnecessary and confusing to the two farmers, so they decided that measurement is the only real method available to those who want to determine the exact nature of heavenly bodies.[140]

Measuring the skies is a futile task that the two friends called, ironically "noelle," a neologism that is supposed to sound Paduan but was, in fact, coined by Galileo on the model of the Latin word, "nugellae," from Catullus's and Petrarch's proemial poems.[141] The two farmers also discuss the distance of the star and the role of the distance from Rua, in the Euganean Hills, which scientists would consider to be an example of parallax or, as the two farmers define it, "the sharpening of vision" ("defenientia de guardamento"). Skies and celestial motions are projected onto the fields where the two farmers are speaking: "you can now consider that if the new star and the Moon were close to this small willow tree, proportionally, then the stars above would be well further down than that tree down there" ("Fa mo to conto, que se la stella nuova, e la Luna ne foesse vesìn co esto salgaretto, a portion, le stelle de sora ne sarae d'on bel pezzo di lunzi, che ne' quell'albara"). In a "subtle speculation, that would be a comment winning mathematicians' speechless approval" ("spelucation sottile per farghe stare i smetamatichi"). Next, they argue on distances and relative perceptions based on items around them, on the fields: for example, the distance between that walnut tree and the river bank can be measured abstractly with their instruments and, afterwards, with a tool ("[…] per aire da sta nogara a k'arzere; e si el lo mesurera' co i suoi ordigni senza muoverse; e co'l l'habbi mesurò, e que' l te l'habbi

[140] Names of scholars are intentionalluy distorted in *Dialogo de Cecco di Ronchitti da Bruzene*: "Stotene" stands for Aristotle. The farmers are upset that an ancient philosopher and his current supporters have such influence, if one considers that Aristotelian philosophers are "so unaware of anything, that they want to speak of the sky." A real misunderstanding of foreign names occurred for Copernico, referred to as "Ipernico" in Niccolò Lorini's preaching, which shows problematic ignorance in criticisms expressed by Galileo's rivals.
[141] "Stoetene queste, e di suo' brighente; ch'i no sa' s'i sea vivi, e si i vuol faellare de cielo . . . on sita hallo cattò, que on mesuraore vaghe speluca[n]to su ste noelle."

ditto, an ti te'l mesureriesi co' un filo"). The misperception of distance through visual illusions is alluded also in Marino's poem, *Adone*: "it became either lighter in color, or farther, I cannot say how, it disappeared in a moment: it looked like a quick fish in a dark river, I do not know if that was because of the distance or because of the way the light was."[142] After exploring nature in their agricultural context, the two characters in Galileo's dialogue in dialect wonder if natural phenomena are different from country to country, because a linguistic medium of expression would not change the substance of what one sees in nature through science. Would it "be possible that there is no parallax among the Spanish, the Germans, and the Neapolitans? And still we all see it [the new star] in the same place, next to those stars that people say" ("E si sarae possibolo, que no ghe foesse da i Spagnaruoli, e i Tuoschi, e i Puletani, defenientia de guardamento? E pure tutti la vè in el mediemo luogo, ape a quelle stelle, che i ghe dise"). Words would be different, but the meaning would be consistent across languages.

Both scholars and curious readers can learn from books, but a certain familiarity with books is evident in the dialogue's final line, when Matthio calls Natale a delusional chivalric knight, or "a new Orlando" ("Mo' va', che te sì on Rolando"), thus confirming the use of Ariosto's epic poem in debates that Crystal Hall has investigated. Debates benefitted from epic imagery in science and mathematics, as one can see in mathematician

[142] "[…] divenuta o più chiara o più lontana, / non so dir come, in un momento sparse: / parve pesce fugace in cupo fiume; / non so se fosse o la distanza o il lume"; *Adone* XI, 172, 5-8). No matter what perceptions are, the poet still records them, to ascertain their nature and traits, later on: "whatever it was, either a real thing or an illusion" ("che, qual si fosse, o sussistente o vana" XI, 172, 3). Extraordinary decisions are necessary, sometimes, so that reason may support sensation, or the unlikely combination of sensorial perceptions. Adonis acts so, "that understanding may understand what senses never captured / perceived, not being able to find another measurement for celestial spaces, outside of nature" ("facciol, perché così quel che non scorse / il senso mai, l'intendimento intenda, / non sapendo trovar fuor di natura / agli spazi celesti altra misura"; X, 107, 5-8).

Tartaglia's solution to the cubic equation which was grounded in epic as well (1539).[143] In her analysis of war motifs in epic poetry, Lina Bolzoni noted that personal contrasts were important components in the epic genre, for example showing in Boiardo's *Orlando innamorato*, so that "the enemy becomes a necessary part of a code in which the conquest of fame is a value in itself, distinct from richness and power, and linked to the demonstration of one's courage and one's sense of honour" (Bolzoni 273-74), and Hall reached similar conclusions for Galileo's scientific controversies. Ariosto's epic poem was a favorite reading of Galileo's, as well as a source of important metaphors and rhetorical hints, as the scientist found characters and situations in the *Orlando Furioso* as examples of real-life situations and scientific controversies.[144]

A sort of cultural parallax is evident in the short Paduan pamphlet, distancing the author and his intended audience from those who deny the real nature of the nova. Therefore, Galileo adopted the metaphor of working around lack of standardized communication, which is not incommunicability, but the realization of a dream for a universal scientific language summarized in the Book of Nature metaphor. That dialogue also preserves Galileo's first mention of Copernicus in a printed book, so that dissimulation

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[143] I find this use of epic tones particularly relevant in *The Assayer*, in Galileo's argument against Sarsi's claims: "Sarsi here puts me in mind of the saying of a very witty poet: 'By Orlando's sword, which they have not / And perhaps which they never shall have / These blows of blind men have been given...'" (Stillman Drake, *Discoveries and Opinions of Galileo*. New York: Doubleday & Co., 1957: 265-66). The poetic quotation is from Boiardo's *Orlando Innamorato* (Boiardo iii, c. vi, 50, 3-5). Crystal Hall has demonstrated that reading and writing represent two facets of an author, given that Galileo's persuasion techniques often draw from epic poems (on Boiardo 27, 94, 99, 201, 226; on Ariosto 24, 71, 88, 95-99, 102; on Tasso 24-25, 71, 79, 99-100; on Marino 28, 209, 237-38). The insertion of lyrical quotations responds to a stylistic device named interlace, as Ross noted: "Although interlace may be strange to us, it is the art that Galileo admired in Ariosto and missed in Tasso; he viewed the latter's transitions as sharp lines, the borders of "inlaid work" (*tarsie*), instead of the gradual shadings of a painter in oil. For Galileo, Tasso lacked invention and was forced to piece together independent ideas" (Boiardo and the Derangement of Epic" l-lxiv in *Orlando in Love*, trans. and ed. Charles Stanley Ross. West Lafayette: Parlor Press, 2004: 1).

[144] Antonio Favaro, *La libreria di Galileo Galilei*. Rome: Tipografia delle scienze matematiche e fisiche, 1887.

in an unfamiliar linguistic medium protected the author from unwanted attention ("è dunque conforme a questo abito chi non s'è tanto ristretto, poiché dal conoscer gli altri nasce quella piena autorità che l'uomo ha sopra se stesso quando tace a tempo, e riserba pur a tempo, quelle deliberazioni che domane per avventura saranno buone, ed oggi sono perniziose", Accetto VII). What remained uncertain, however, was the best way to incorporate newly observed astronomical phenomena into a new world system, and that is why correspondence and innovative research played such a significant role in Galileo's scientific agenda. The rhetorical and communicative frameworks of Galileo's writings, including many of his most famous published and unpublished works, have long interested literary scholars, historians, philosophers, and art historians, in particular regarding the word for "experiment" ("experientia") that had not been univocal before Galileo.[145] The scientific account of what happens in an experiment, real or thought, intersects with beauty, wonder, and the surprise of making learning possible through descriptions. That aspect of pedagogical practices was also important in exact sciences, as we will see on quantification in Chapter Three, and in medical disciplines in Chapter Four.[146]

[145] Similar studies have been carried out for English vocabulary by Steven Shapin and Simon Schaffer in their book *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985).

[146] Robert P. Crease, *The Prism and the Pendulum*: xiii-xxiii Introduction, "The Moment of Transition" as experiments can be called beautiful.

4. Writing the Book of Nature: Characters and Ciphers.

The Book of Nature can, at first, look like a riddle, before one can interpret characters through geometry and mathematics.[147] In his 1623 book, Galileo acknowledged characters to be the foundational blocks of a language's alphabet, the same that would be used for printing blocks that transfer letters to a printed medium. Years later, one of Galileo's fictional messengers, Sagredo, praised the characters of the alphabet, whose combination allowed us to write and communicate across space and time, and at the end of the first day of the 1632 *Dialogue*, he spoke as follows:

> But surpassing all stupendous inventions, what sublimity of mind was his who dreamed of finding means to communicate his deepest thoughts to any other person though distant by mighty intervals of place and time! Of talking with those who are in India; of speaking to those who are not yet born and will not be born for a thousand or ten thousand years, and with what facility, by the different arrangements of twenty characters upon a page![148]

Galileo used all potential tools of language when he found more languages and styles, but also achieved secrecy by hiding his intentional meaning through coded messages, thus developing a long tradition in diplomatic correspondence.[149] In *The Assayer*, Galileo had promised to clarify "the role of human interpretations upon natural phenomena" ("la forza dell'umane autorità sopra gli effetti della natura"). As I discussed in Chapter One, the parallelism between the Book of Nature and the Scripture constructed concurrent, universal

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[147] See *Adone* II, 215; IV, 49; VI, 364; VIII, 491; XI, 200, 369; XVIII, 263, 332.
[148] End of the First Day, *Dialogo sopra i due massimi sistemi del mondo*, ed. Drake.
[149] The Republic of Venice and Florence were the main political centers in which Galileo worked. Both political areas had an established tradition in encoding and decoding messages as well, because diplomatic representatives needed to communicate safely through letters. See Antonio Favaro, "Elementi di un nuovo anagramma galileiano." *Scampoli galileiani*, ed. Lucia Rossetti and Maria Laura Soppelsa. Trieste: Edizioni LINT, 1992, 2:446-47. 2; George Sarton, "Notes on the History of Anagrammatism." *Isis* 26.1 (1936): 132-38, and Eileen A. Reeves, "Something of a Cipher: Galileo's Anagrams." In *Tintenfass und Teleskop: Galileo Galilei* etc., ed. Andrea Albrecht, Giovanna Cordibella, and Volker Remmert.Berlin: Walter de Gruyter, 2014, 15-31.

metaphors centered on three main elements: the book, nature, and the language in which the book is written. Therefore, Galileo questioned the authority of earlier interpretations that prevented scientists from elaborating new theories that would explain natural phenomena. In the second day of the *Dialogue*, Sagredo discussed the "combinatorial effect of language" (Marcus and Findlen 978) to cover all scientific topics, while also admitting that all questions can be addressed through language. Sagredo said:

> I have a little book, much briefer than Aristotle or Ovid, in which is contained the whole of science, and with very little study one may form from it the most complete ideas. It is the alphabet, and no doubt anyone who can properly join and order this or that vowel and these or those consonants, with one another can dig out of it the truest answers to every question, and draw from it instruction in all the arts and sciences (*Dialogo* 2001, 126).

While characters and ciphers were symbolic for knowledge itself, Galileo used ciphers to hide, popularize, and advertise his own scientific work at the same time.[150] When Galileo was drafting the *Starry Messenger*, he considered using anagrams to share his discoveries (*OG*, III, 2, 876).[151] The keys to secretive riddles might have been both mathematical or linguistic solutions, as Galileo envisioned them, thus innovating traditional coded messages at the time when "[…] even carefully coded correspondence was not strictly secret" (Marcus and Findlen, 985) in those cases in which a go-between would be necessary

[150] As Marcus and Findlen pointed out, even communication on Galileo's death needed secrecy. The papal nuncio in Florence, Giorgio Bolognetti, wrote a coded message to Cardinal Francesco Barberini, the nephew of Pope Urban VIII. Discretion and caution were necessary, Marcus and Findlen argued in their recent essay, because "even if Galileo was Tuscany's, and perhaps even Europe's, most renowned scientist, he was also a penitent Catholic following his trial and condemnation by the Roman Inquisition in 1633 for advocating heliocentrism" (Marcus and Findlen 955).

[151] Only one single page of these experiments is extant. Antonio Favaro and, more recently, Massimo Bucciantini, Michele Camerota, and Franco Giudice discussed those notes as Galileo's first attempt to write enigmatically.

to decipher and interpret a message.[152] The mouth, it is true, is the first messenger of human speech, since only humans can speak, as Marino repeatedly said throughout the poem *Adone*. Reasoning, understanding, and communication are human endeavors; expressing thoughts is uniquely human.[153]

Secrecy occurs also in poems and their comments on science, for example in Adonis' experience, thinking, desire, and deep secrets are expressed through speaking ("lingue del pensier") and writing in any alphabet that one can decipher ("geroglifici e libri . . . legger le note" *Adone* VI, 36, 5-8).[154] When secret messages were needed, cryptographic techniques allowed for secrecy but also fostered free communication between scholars.[155] After all, dissimulating a letter's contents was an individual's choice, and the messages could be shared as long as an interpretive key was shared.[156] At the same time, nature looks complex and needs some deciphering for scientists, as a riddle. Enigmas and riddles in Galileo's works are part of Baroque games, when words and anagrams looked like "a kind of knowledge game" (Marcus and Findlen 971) whose secret ciphers could serve scientific or political purposes. Discoveries fascinated both scientists and scientific-oriented poets so that "nothing remains hidden, let everything be revealed," a goal included in a very Baroque conceit by Marino ("nulla si celi a lui, tutto si mostri"

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[152] For more details on correspondence and secrecy, see Sergio Chieppi, *I servizi postali dei Medici dal 1500 al 1737*. Arezzo: Servizio editoriale fiesolano, 1997; Hans Cools, Marika Keblusek, and Badeloch Noldus, eds. *Your Humble Servant: Agents in Early Modern Europe*. Hilversum: Verloren, 2006.

[153] Maurice Finocchiaro, *Galileo and the Art of Reasoning*. Dordrecht, Holland; Boston: D. Reidel Pub. Co.; Hingham, MA, 1980.

[154] The full passage reads: "Son lingue del pensier pronte ed accorte / e del muto desir messi loquaci; / geroglifici e libri, ov'altri pote / de' secreti del cor legger le note" (*Adone* VI, 36, 5-8).

[155] See Katherine Ellison, "Millions of Millions of Distinct Order. Multimodality in Seventeenth-Century Cryptography Manuals." *Book History* 14 (2011): 1-24, and Eileen A. Reeves, *Evening News: Optics, Astronomy, and Journalism in Early Modern Europe*. Philadelphia: University of Pennsylvania Press, 2014.

[156] "In sostanza il dissimular è una professione della qual non si può far professione, se non nella scola del proprio pensiero. Se alcuno portasse la maschera ogni giorno, sarebbe piú noto di ogni altro, per la curiosità di tutti; ma degli eccellenti dissimulatori, che sono stati e sono, non si ha notizia alcuna" (Accetto V).

Adone VI, 23, 8).[157] The Baroque pleasure of solving a game is clear for Marino, too, who praises someone "keen at interpreting secret ciphers" ("secrete cifre interpretar s'ingegna" *Adone* XII, 19, 5-6), thus approximating truth and knowledge as close as possible.

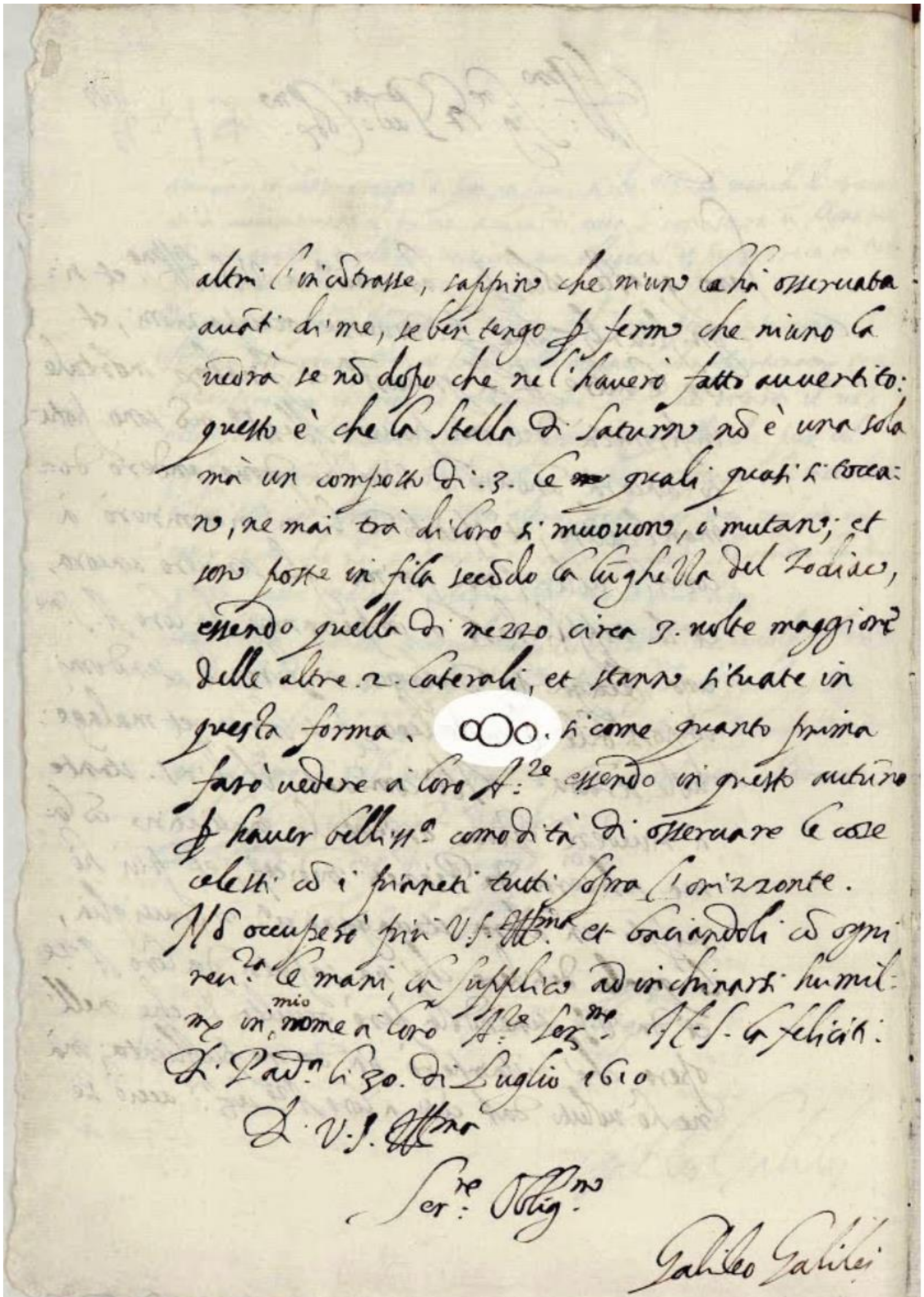
Both humanistic and scientific communication thrive in mutual understanding and occasional secrecy, so that the knowledge of the humanities, and any human language, can be assimilated to science. As Kuhn noted, "[…] scientific knowledge, like language, is essentially the common property of a group or else nothing at all. To understand it we shall need to know the special characteristics of the groups that create and use it" (Kuhn 210). Unveiling the message became part of the communication process, so that recipients could understand what a form of secrecy was of "parlar figurato," that is, alluding, veiling, and conceiling information. Hidden messages had been, intentionally or not, present in the Bible, too, as Galileo explained in the 1615 letter to Christina of Lorraine (*OG* V, 307-48). Additionally, passing around mysterious knowledge would increase its value to the owner, as well as amplify the pleasure of learning for the recipient through scientific knowledge used as the valuable currency in reading, and writing games for scholars.[158] While Galileo

[157] For the sacred character of books and their associations with authority, see Curtius 303-04. Poet Marino also combined the sacred and the prophane, and Biblical matters with metaphorical books, when the visual image of a book shows in passion flowers that remind the author of Christ's passion (*Adone* VI, 139, 1-8). In another instance in *Adone*, Apollo and Hyacinthos recounted their vicissitudes and the impact those facts had on nature, when flowers bear important features of what has become a narration trait, into their inner and outer qualities: "and I had a flower out of the dead body / spring out thanks to my star, that bears on its leaves traces of blood / the written traces of his disgrace and my sorrows" ("e feci un nobil fior dal corpo morto / pullular in virtù dela mia stella, / che con note di sangue ha su le foglie / scritte le sue sventure e le mie doglie"; *Adone* XIX, 61, 5-8).

[158] In a letter to Medici secretary Belisario Vinta, Galileo also included a drawing of three circles (30 July 1610, from Padua): "Ho cominciato il dì 25 stante a rivedere Giove orientale mattutino, con la sua schiera de' Pianeti Medicei, et più ho scoperto un'altra stravagantissima meraviglia, la quale desidero che sia saputa da loro A.ze et da V. S., tenendola però occulta, sin che nell' opera che ristamperò sia da me publicata: ma ne ho voluto dar conto a loro A.ze Ser.me, acciò se altri l'incontrasse, sappino che niuno la ha osservata avanti di me; se ben tengo per fermo che niuno la vedrà se non dopo che ne l'haverò fatto avvertito. Questo è, che la stella di Saturno non è una sola, ma un composto di 3, le quali quasi si toccano, né mai tra di loro si muovono o mutano; et sono poste in fila secondo la lunghezza del zodiaco, essendo quella di mezzo circa 3 volte maggiore delle altre 2 laterali: et stanno situate in questa forma, sì come quanto prima farò vedere a

revealed discoveries on the planet Saturn in clear terms in a sketch to the Medici secretary of state, Belisario Vinta, he was also playing a knowledge game with, and against fellow astronomers to protect his discovery until publication, or endorsement of his priority. His sponsors, however, had a right to learn about his discoveries early, whereas other correspondents were not privy to the real discussions.

loro A.ze, essendo in questo autunno per haver bellissima comodità di osservare le cose celesti con i pianeti tutti sopra l'orizzonte" (*OG* X, 409-10).



altri l'incontrasse, sappino che niuno l'ha osservata
avanti di me, se ben tengo per fermo che niuno la
vedrà se nō dopo che nel'haverò fatto avvertito:
questo è che la Stella di Saturno nō è una sola
mà un composto di 3. le quali quasi si tocca:
no, ne mai tra di loro si muovono, ò mutano; et
sono poste in fila secondo la lunghezza del Zodiaco,
essendo quella di mezzo circa 3. volte maggiore
delle altre 2. laterali, et stanno situate in
questa forma. oOo. sicome quanto prima
farò vedere a loro A.ze essendo in questo autunno
per haver bellissima comodità di osservare le cose
celesti co i pianeti tutti sopra l'orizzonte.
Nō occuperò più V.S. Ill.ma et baciandoli co ogni
reverenza le mani, la supplico ad inchinarmi humil:
me in mio nome a loro A.ze Ser.me N.S. la felicità.
Di Pad.a li 30. di Luglio 1610
Di V.S. Ill.ma
Ser.re Oblig.mo
Galileo Galilei

Figure 4. An excerpt from a letter to Belisario Vinta. Galileo wrote that letter from Padua on 30 July 1610 (Firenze, Biblioteca Nazionale Centrale, Ms. Gal. 86, c. 42r; *OG* X, 409-10).

Communicating with sponsors on all scientific discoveries was needed, in the public sphere, so that they could acknowledge Galileo's priority in the discovery, as per letter dates. If any of those letter recipients wanted to learn more, Kepler and the Emperor included, they needed to ask and interact with Galileo on his own terms. Galileo composed his first astronomical enigma in 1610, in Latin, in a letter he sent to Johannes Kepler, the Imperial Astronomer and Mathematician. In the months following the publication of the *Sidereus Nuncius*, in March 1610, Galileo became famous after his discovery of Jupiter's satellites that he named "Medicea sidera" in a political homage to the Medici family.[159] Galileo, instead, concealed his discoveries of Saturn's rings for "political, diplomatic, and strategic purposes" (Marcus and Findlen 964). As Mario Biagioli noted, deciphering the anagram by Galileo implied ability in both astronomy and mythology. That year, Kepler had heard from friends about Galileo's discoveries with the spyglass. He read Galileo's *Sidereus Nuncius*, published just in March of 1610, and in response to Galileo's observations, he quickly wrote a long letter of support which he published as *Dissertatio cum Nuncio Sidereo* ("Conversation with the Starry Messenger"). Later that year, Kepler obtained a telescope with a good resolution, so that he could see Jupiter's satellites, and he published those results in *Narratio de Observatis Quatuor Jovis Satellitibus* ("Narration about Four Satellites of Jupiter Observed").

Kepler's treatises, quickly reprinted in Florence, supplied authoritative support to Galileo's theories, at that time doubted or denied by Ludovico delle Colombe, Cremonini, and many more. The following year, Kepler continued what he saw as a mission of

[159] "[…] ma Giove ancor sotto gli auspicii miei / scorgerai d'altri lumi intorno cinto / onde lassù de l'Arno i Semidei / il nome lasceran sculto e dipinto" (*Adone* X, 44, 3-6). On scientific intellectual work and the immortality Galileo gains through it, see *Adone* X, 46, 5-8; 47, 5-8.

scientific inquiry and a divine investigation of nature. In the book *Dioptrice* ("Dioptrics," 1611), he delineated a theory of the telescope and published a version of Galileo's coded correspondence in the introduction.[160] Emperor Rudolf II was looking forward and growing impatient to find out the answer to Galileo's astronomical riddle, as was Kepler, the Royal Astronomer, but "Galileo remained silent, capitalizing on the fact that a secret could be more powerful if it were not immediately revealed" (Marcus and Findlen 965). Finally, Galileo sent the solution to the imperial court in Prague three weeks later, on 1 January 1611.[161] There were, though, different plans for Galileo to communicate in the Veneto, when he addressed intellectuals regularly meeting at his friend Gian Vincenzo Pinelli's library. No secrecy was needed for those friends, but a delayed answer to possible rivals came finally in May 1612, in response to Welser, when Galileo claimed that his discovery of the phases of Venus had been so widely circulated, that it had become famous. Galileo commented on the new Medicean stars he had seen, situating his discovery in historical perspectives, when he wrote a long letter to Piero Dini, dated 16 May 1611 (*OG*, XI, 105-16):

> […] non in tutti i secoli passati si erano con poca fatica imparate le scienze a spese di altri sopra le carte scritte, ma che i primi inventori trovarono et aqquistarono le cognizioni più eccellenti delle cose naturali e divine con gli studii e contemplazioni fatte sopra questo grandissimo libro, che essa natura continuamente tiene aperto innanzi a quelli che hanno occhi nella fronte e nel cervello; et che più honorata e

[160] Marino praised epic poems, alluding to Ariosto and Tasso as poets who "would sing about war and love on the banks of the river Po" ("che 'n su 'l Po canteran guerre ed amori" *Adone* X, 164, 8).

[161] See Van der Heuvel, Charles, Scott B. Weingart, Nils Spelt, and Hank Nellen. "Circles of Confidence in Correspondence: Modeling Confidentiality and Secrecy in Knowledge Exchange Networks of Letters and Drawings in the Early Modern Period." *Nuncius* 31.1 (2016): 78-106. Scholars, among whom Gingerich, Marcus and Findlen believe that the Emperor Rudolf II and Kepler had bonded over Galileo's riddles, all the while trying to find their own answer to the mysterious lines penned by Galileo (Robert John Weston Evans, *Rudolf II and His World: A Study in Intellectual History 1576-1612*. Oxford: Oxford University Press, 1973). Individual requests to reveal an answer to astronomical riddles came to Galileo from Kepler and the Scottish intellectual Thomas Segeth (*OG* X, 455). See also *Kepler's Conversation with Galileo's "Sidereal Messenger."* Ed. and trans. Edward Rosen. New York: Johnson Reprint Corp., 1965; Walther Dyck and Max Caspar, eds. *Johannes Kepler Gesammelte Werke*. 26 vols. Munich: C. H. Beck, 1937-1969.

> lodevole impresa era il procurar con le sue proprie vigilie, studii e sudori, di ritrovare qualche cosa admiranda e nuova tra le infinite che ancora nel profondissimo abbisso della filosofia restano ascose, che, menando vita oziosa et inerte, affaticarsi solo in procurar di oscurar le laboriose invenzioni del prossimo, per escusar la propria codardia et inettezza alle speculazioni, esclamando che al già trovato non si possa aggiugner più altro di nuovo. Ma ciò sia detto come per digressione, et non come punto che direttamente appartenga alle risposte de i dubbi scritti: et perdonimi V.S. R.ma questa scorsa di penna (*OG* XI, 112-13).

Discoverers reveal new facts found in nature, and in writing, Galileo argued, those authors also celebrated the "very great book" that nature itself is, while other things remain hidden in philosophy. The use of hidden communication was frequent for new scientific discoveries in letters by Galileo, through ciphers. Ciphers could be guessed at, but they could also travel as separate attachments, as we can gather from a letter written by Niccolò Aggiunti, an esteemed correspondent of Galileo's.[162] Beside ciphers, Galileo also used "gergo," a secretive form of communication where words have a different meaning than their conventional one. At the time, John Florio translated the word "gergo" in his 1598 Italian-English dictionary, as "Peddler's French" or "Gibberish," and that would become the English equivalent for jargon. The *Vocabolario* of the Accademia della Crusca (1612 edition), which would later include Galileo among its members and make his language choices a model for writing good Tuscan, lists *gergo* as one of the definitions for the concept of enigma (*enimma*).[163] Both ciphered communication and jargon became

[162] "Ho voluto veder se mi riusciva l'adoperar la chiave che a questi giorni V. S. ci ha data attissima ad aprire infiniti secreti in materia di spezzamenti etc., e perciò ho tentato di risolver il problema da lei accennatomi: glielo mando, acciò veda se io ho preso un granchio" (17 September 1633; *OG* XV, 266).

[163] The trusted Geri Bocchineri wrote and referred to 'gergo' when writing to Galileo, for example on 9 July 1633 ("non può intendere l'aggiunta lettera in gergo, se prima non haverà ricevuta un'altra mia, con diversi nomi pure in gergo, che la settimana passata le mandai a Roma, sotto coperta al solito del S.r Ambasciatore, il quale veniva pregato di fare havere a V. S. tale mia lettera in propria mano, et credo che S. E. le ne haverà mandata: però in ogni caso V. S. la procuri"; *OG*, XV, 172-73). Galileo owned a copy of Raffaele Frianoro's *Vagabondo* (1627), a book on *gergo* or *zergo* that was a secret system of communication for thieves, and that book was a popular publication until the end of the eighteenth century. See Piero Camporesi, ed. *Il vagabondo di Rafaele Frianoro e altri testi di "furfanteria."* Torino: Einaudi, 1973.

fundamental practices after the 1633 Inquisition trial, making it illegal to discuss topics of Copernican astronomy.

Self-reflection is an important part in the scientific thinking process and the communication of scientific results, so that authors can present their ideas and protect their public image. Torquato Accetto wrote on conformity and dissimulation as a form of hypocrisy that is, though, necessary to protect both one's reputation and inner thoughts, as he had to do himself: "lo scriver della dissimulazione ha ricercato ch'io dissimulassi" (*Della dissimulazione onesta*. Napoli: Egidio Longo, 1641, Preface). A clear definition of such strategic thinking and acting is that, by dissimulating, one does not show things as they are to feign what is not, and deny what is.[164] Nature, too, seems to dissimulate at times, when people mistake natural appearances.[165] Dissimulation could involve one's behavior and thoughts, but also their intentions and messages, so that all communicative functions could be veiled and unveiled when needed, at the right time:

> […] non essendo altro il dissimulare, che un velo composto di tenebre oneste e di rispetti violenti: da che non si forma il falso, ma si dà qualche riposo al vero, per dimostrarlo a tempo; e come la natura ha voluto che nell'ordine dell'universo sia il giorno e la notte, così convien che nel giro delle opere umane sia la luce e l'ombra, dico il proceder manifesto e nascosto, conforme al corso della ragione, ch'è regola della vita e degli accidenti che in quella occorrono" (Accetto IV).[166]

Those considerations, framed within a celestial order in astronomy, will be leading points as I trace the Book of Nature metaphor and structure in early modern texts for which it is

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[164] "La dissimulazione è una industria di non far veder le cose come sono. Si simula quello che non è, si dissimula quello ch'è" (Accetto VIII).

[165] "Giova dunque una certa dissimulazion della natura, per quanto si contiene tra lo spazio degli elementi, dov'è molto vera quella proposizione che afferma di non esser tutt'oro quello che luce" (Accetto IX).

[166] […] dissimulating consisting in a veil of honest darkness and violent respect, from which one does not find falsehood, but a pause to the truth, in order to show it at the right time. As nature wanted both day and night in the order of the universe, thus befits in human vicissitudes to have both light and shadow, I mean, the clear and hidden ways of handling things, appropriate to the use of reason that regulates life and everything occurring in it [translation mine].

important to consider the impact and cultural consequences of the circulation of ideas (scientific observation), instruments ("cannocchiale" or "telescopio"), and diseases (syphilis and plague).[167]

Secrecy coexisted with broad distribution of texts in printing. Communicating science through print made stylistic conventions more urgent. "The reason why a vast farrago of poems, and of verses, in that language (Italian) proliferate is the effortless German invention, that for a price prints everything," Marino acknowledged.[168] Printing presses circulated scientific contents at rates that were unimaginable in manuscript forms, but careful considerations were necessary for politically-charged topics such as Copernican astronomy. In order to defend Copernican ideas, especially in the *Dialogue*, Galileo did not further investigate coherence and sectarian adhesion to Copernicus's hypothesis, nor did he distinguish between hypotheses and theories, a distinction than Bellarmino insisted upon, possibly without ever comprehending the original intentions behind Copernicus's speculations.[169]

For reasons of secrecy and self-preservation, Galileo experimented with language possibilities, identifying scientists' support to Copernican theories, a task which required secrecy. Thus, the phrase "of our order" became a way to mean, obliquely, those who were Copernican, or supporters of heliocentric theories (*OG* XVIII, 197). Galileo had first been open about his support of Copernicus, whereas Accetto wrote that the unconditional love

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[167] Similarly, in Marino's poem *Adone*, alongside real motions, fictionally imagined motions occur in automata mechanisms: "If the fruit we are fighting for, / without intelligence, could feel, / you would see it run towards me" ("Se 'l pomo, per cui noi stiam qui pugnando, / come senso non ha, potesse averlo, / tu lo vedresti a me correr volando" *Adone* II, 105, 1-3).

[168] "Che di Poemi in quella lingua cresca / numerosa ferragine, e di Rime, / la facil troppo invenzion tedesca / n'è cagion, che per prezzo il tutto imprime" (*Adone* X, 165, 1-4).

[169] See Dino Boccaletti, "Galileo and the Equations of Motion" (59) in the edited volume *Galileo e Copernico* with proceedings from the 1985 conference in Acquasparta where scholars honored four hundred years after Federico Cesi's birth.

of truth could have damaged one who is too frank about his own beliefs.[170] Supporters or opponents to ideas are, according to Accetto, visible in people's countenance, "though with invisible fonts."[171] That analogy proves the influence of Galileo's insights into man as a microcosm, that Accetto called "a small world" in an elaborate geometric demonstration of lines intersecting a circumference.[172] The parallelism between humans and Renaissance ideals of self-sufficient beings extends as far as actions.[173] Dissimulation, thus, was a necessary skill and action to thrive as intellectuals, and one in compliance with Torquato Accetto's recommendations.[174]

[170] "[…] tanto piú quanto mi ricordo il danno che averebbe potuto farmi lo sfrenato amor di dir il vero, di che non mi son pentito; ma amando come sempre la verità, procurerò nel rimanente de' miei giorni di vagheggiarla con minor pericolo" (Accetto I).
[171] "[…] se la verità non fosse andata per le bocche di quella pur troppo bene avventurata gente, se non fosse stata scritta nel candore di que' magnanimi petti con caratteri (benché invisibili) di buona corrispondenza; però non bisognava che 'l sí, e 'l no, si menasse i testimoni appresso" (Accetto II).
[172] "[…] cosí l'uomo, ch'è un picciol mondo… a questo modo non si può far inganno a se medesimo, presupposto che la mente non possa mentire con intelligenza di mentire a se stessa, perché sarebbe veder e non vedere; si può nondimeno tralasciar la memoria del proprio male, per qualche spazio, come dirò; ma dal centro del petto son tirate le linee della dissimulazione alla circonferenza di quelli che ci stanno intorno" (Accetto III).
[173] "E se pur sempre non vediamo nelle cose mortali quell'ordine infallibile che si manifesta nel moto del sole, della luna e dell'altre stelle, anz'in molta confusione spesse volte si truovano i negozii di qua giú, non manca però la certezza dell'eterna legge, che tutto sa applicar ad ottimo fine" (Accetto XVII).
[174] Marcus and Findlen have discussed Galileo's use of encrypted correspondence in important moments of his life: in 1610, after the *Sidereus Nuncius* had been published, and in 1633, after the Inquisition trial. See Hannah Marcus and Paula Findlen, "Deciphering Galileo: Communication and Secrecy before and after the Trial." *Renaissance Quarterly* 72 (2019): 953-95.

5. Experience in Nature, Art, and Thoughts: Mirroring Nature.

The Book of Nature metaphor became a model for Galileo's understanding and vision of nature.[175] An experiment of Galileo was important in the *Dialogue*, when the relativity of viewpoints on a ship demonstrated that the nature of motion can be, apparently, confusing for someone who is moving, though unaware of such motion.[176] Replicating nature through experience (and guided experiments) allowed scientists to study natural phenomena in other ways. Galileo, for example, introduced the paradoxical experience of someone traveling at sea and the unclear sensation that the mainland might be moving, while the ship would be still, which scholars classify as one of several "thought experiments."[177] The experiment at the tower of Pisa has been discussed by Robert Crease as a fictional fact, "the legend of the Leaning Tower" (Crease 21-35; 39-40), though for different reasons; it is known that Vincenzio Viviani contributed to crafting the experiment, or he "enacted for what might have been the very first time" as I. Bernard Cohen said in his 1956 visit to Pisa. Scholars also expressed skepticism because of a water timer that Galileo claimed to have used for the 1604 experiment, but Alexandre Koyré did not think that experiment was possible under those conditions, until Thomas B. Settle reenacted the experiment with the help of some friends during his graduate studies at Cornell

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[175] Lawrence Lipking, *What Galileo Saw: Imagining the Scientific Revolution*. Ithaca & London, Cornell University Press, 2014.

[176] "The book of nature may be written in the language of mathematics, but the alphabet in which this language is written is nature itself, namely material bodies in motion" (Jesseph 204).

[177] "Dissimulating with words and writing in jargon had many social and cultural meanings by the early seventeenth century. Even Simplicio, the stubborn Aristotelian character in Galileo's *Dialogue*, imagined how 'a letter might be written' on a ship traveling along the surface of the moving earth, after being asked by his interlocutor, Sagredo, to contemplate the effect of a voyage from Venice to Alexandretta on the line drawn by a pen held by someone onboard throughout the entire trip. Trying to understand if a written character would remain the same when the world around it was in motion was yet another opportunity to contemplate the potentially paradoxical relationship between writing and the great enigma of nature, capable of producing utter clarity of thought in one hand, and a *gergo* in another" (Marcus and Findlen 977).

University.[178] Another scholar who studied at Cornell, Stillman Drake, supported the theory that scientists used musical units to keep track of time because Galileo was a lute player, and Drake's understanding of music, harmony, and time keeping contributed to such interpretation of experiments that he was considering in his studies in what is, once more, another perspective on thought experiments.[179]

The illusion of movement had been present in poetical tones, too, when Marino commented that "[…] when there is a good breeze, / the beach moves away, little by little, / so that he [the traveler] gazes back from the sea, towards the mainland / he has the feeling that the mainland itself is moving, instead."[180] Kuhn argued that imagery and cases based on an original model would increase, as he stated that "[…] gradually the number of experiments, instruments, articles, and books based upon the paradigm will multiply" (Kuhn 159). Experiments such as the fall of gravity, or the pendulum, would be in a category in which Crease recognizes esthetic beauty in "pattern-emergence" (Crease 52). The force of gravity, for example, is perceived in poems in which observers experience marvel alongside with the scientific phenomenon: "everyone is surprised at seeing that the weight of the links / moves upwards like a bouncing ball" ("Stupisce ognun che dele membra il peso / estolla al ciel qual ripercossa palla" *Adone* XX, 105, 3-4).[181]

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[178] Years later, Settle published the findings in "An Experiment in the History of Science." *Science* 133 (1961): 19-23.

[179] William J. Broad, "New Attack on Galileo Asserts Major Discovery Was Stolen" *New York Times* (13 December 1983). Stillman Drake became an historian of science and taught at the University of Toronto since 1967, bringing one of the best Galileo collections in private hands, now known as the "Galileo Collection" in the Rare Books and Special Collections Department, second possibly only to the manuscripts in Florence. Another important collection of literature on Galileo studies was donated by historian of science Annibale Fantoli to the University of Victoria in British Columbia.

[180] "Ed ecco al sospirar d'agevol ora / s'allontana l'arena a poco a poco, / sì che mentr'ei dal mar si volge ad essa, / par che navighi ancor la terra istessa" (*Adone* I, 55, 6-8).

[181] See *Adone* V, 329-30.

Looking for details to understand nature required helpful resources to match visual and textual correspondences in nature. The concept of visible connections between images and words, "ut pictura poesis" ("poetry is like painting") as formulated in Horace's *Ars Poetica* (I, 361).[182] Such expressions had become commonplace in Renaissance and early modern scholarship, establishing a fundamental comparability between literary and visual arts, as connected representations of nature (Larrabee 881-2).[183] As Marino wrote, "Nature displays a wonderful craftsmanship in each beautiful work of hers, one cannot deny that."[184] Furthermore, Marino connected disciplines that deal with the investigation of nature such painting, sculpture, geometry, craftsmanship, and art more broadly.[185] Sculptors and painters are compared, for each of their work shows analogies with nature and other artistic media: "a sculptor in marble, or a painter on paper."[186] As a poet, Marino established parallelisms between painting and writing, between painters and poets, so that he considered both forms of expression as legitimate art, the only difference being the style, pictorial and textual, respectively. As a writer who was aware of the potential and limits of genres, Marino challenged the alleged boundaries and supremacy of his own art, that is, poetry as the imitation of truth (II, 141, 1-2; XI, 30, 5-6), and he also wrote a collection of poems, *La Galeria*, describing famous paintings of the time in ekphrasis narrations.[187]

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[182] Horace, *The Collected Works of Horace*, trans. Lord Dunsany and Michael Oakley. London: J. M. Dent, 1961.
[183] S. Larrabee, "Ut pictura poesis," *The Princeton Encyclopedia of Poetry and Poetics*, ed. Alex Preminger (Princeton: Princeton University Press, 1974); Renssalaer W. Lee, Ut Pictura Poesis: *The Humanistic Theory of Painting*. New York: Norton, 1967; Marshall McLuhan, *Understanding Media: The Extensions of Man*. New York: McGraw Hill, 1964; W. J. T. Mitchell, "Word and Image." *Critical Terms for Art History*, eds. Robert S. Nelson and Richard Shiff. Chicago: University of Chicago Press, 1996.
[184] "Mirabil arte in ogni sua bell'opra / (ciò negar non si può) mostra Natura" (*Adone* VII, 39, 1-2).
[185] "[…] it was the production of Vulcanus, the thinking of Apollo" ("fu lavoro di Vulcan, pensare d'Apollo" *Adone* XIII, 173, 8).
[186] "Scultore in marmo o ver pittore in carta" (*Adone* XIX, 26, 5).
[187] This type of considerations has been present in my digital work as a Scholar Advisory Member at PHAROS, The International Consortium of Photo Archives (http://pharosartresearch.org), where I have been investigating uses, accessibility, and metadata of early modern images, illustrations, and artworks (2019-

Such beauty in nature is particularly inspiring for visual artists and for poets as well. Painters instinctively look for beauty, in all details, so that the big picture and the close-up vision are both preserved in art, "as a painter who finds more wit and attractions in a smaller figure, more than in a big one, he uses, at times, greater care and attention in smaller things."[188] From such perspectives, a painter's work is not different from a scientist's who would describe tasks and experiments for their queries while keeping and updating a general overview of nature as an entity.[189] The value of experience, thus, makes it worthy to repeat what follows in the description of experiments, both performed and imagined in a fictional narrative, in Galileo's texts.

For art and texts, action words for painters are interchangeable with those for poets, "descriver," "to describe," because Marino appealed to the etymological origins of the word as it captures the meaning of writing fully, in all details.[190] The common nature of poetry and painting allows an exchange of instruments: "let your paintbrush teach my pen" ("insegni ala mia penna il tuo pennello" *Adone* XVIII, 99, 8). Consequently, the highest

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2021). Their collections include nearly 1.5 million images from early modern artworks and documentation at the Frick Collection; I Tatti at Harvard, Fondazione Federico Zeri, Bibliotheca Hertziana, Max Planck Institute for Art History, and Bildarchiv Foto Marburg. Photographs of artworks are subject to copyright for sculpture, the only case when photographers present a unique angle, vision, and perspective of the artwork, thus making it unique, thus copyright worthy.

[188] "[…] ma qual Pittore che 'ngegno e studio scopra / vie più che 'n grande, in picciola figura, / ne le cose talor minime adopra / diligenza maggiore, e maggior cura" (*Adone* VII, 39, 3-6).

[189] Modern experiments make headlines, as was the case for the CERN in Geneve and, after the Moon landing in 1969, for NASA's Lunar Feather Drop on 2 August 1971, an experiment that became iconic of scientific discovery in modern times (http://vesuvius.jsc.nasa.gov/er/seh/feather.html). In the Renaissance and early modern period, diplomatic envoys sent news ("avvisi") informing rulers about novelties and relevant updates on matters of interest.

[190] The *Vocabolario degli Accademici della Crusca* (first edition, 1612) records three meanings: "figurar con parole" that corresponds to the Latin verbs "describere," "delineare;" "registrare, pigliare in nota" deriving from the Latin phrase "numero comprehendere" and, by extension, "semplicemente scrivere." Consequences of this lexical situation will be explored in Chapter Three in terms of writing, describing, and enumerating observations and deriving concepts and theories. Not only textual sources, but also visual ones contribute to communication, so that a series of people, almost allegories and symbols themselves, communicate to the best of their abilities as follows: "each of them with a silent speech / speaking, they hold a tablet, a book, a rod, or a lamp" ("Ciascuno in man con un parlar che tace / tiene o lamina o libro o verga o face" *Adone* XII, 187, 7-8).

achievement in art is the combination of sculpture and painting, bringing the resemblance as close to natural looks as possible, a theme that was discussed for the two arts in Castiglione's *Il cortegiano* (*Book of the Courtier*, 1528).[191] With linear or three-dimensional perspectives, illusions could confuse viewers, so that seeing a peacock makes one think of "a blooming garden, a starry sky" ("un giardino fiorito, un ciel stellato" *Adone* XX, 325, 8).

Accordingly, revolutionary aspects of Scientific Revolutions are found in scientific contents, as well as in the adaptations of humanistic modes, forms, and contexts to discuss science in poems.[192] This area of my work examines the influence of Galileo on Marino's poem, *Adone*, and celebrations of science, art, and technology in poems by Marino's followers, called "Marinisti." In a sort of naturalism of language and imitation within nature, "each simple accent was a word" ("Ogni semplice accento era parola" *Adone* VII, 25, 5). The poem *Adone*, as delineated in the book's opening remarks by Jean Chapelain, is a perfect case of Aristotelian epic (Bolzoni 271), published and circulated in peculiar circumstances that Lina Bolzoni explored for the longest poem in Italian literature, dating back to 1623, and an unusual publication bearing a dedication to the French king and the king's Tuscan mother, Maria de' Medici.

In Marino's poems, and those by his followers, natural systematization in poems still responded to philosophical and scientific frames of understanding nature. Concurrent imagery to explain nature was part of a system of knowledge in which visual systemizations of the world, theater, maps, and trees of knowledge became important

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[191] "Both sculpture and painting are paired in those [artworks]" ("e scultura e pittura accoppia in esse" *Adone* IX, 111, 8).

[192] See René Raphael, *Reading Galileo: Scribal Technologies and the "Two New Sciences."* Baltimore, MD: Johns Hopkins University Press, 2017.

metaphors, thus paradigms, of systematic knowledge in the early modern period. Collections in "Wunderkammern" in Northern Europe flourished on the principles of including what was unique and marvelous, whereas special collections flourished locally in Italy around political leaders, for example in the Guardaroba Medicea in Florence.

One of those visual metaphors, the theater, works for Marino to develop science in prose and poetry within "a small theater" ("in picciol teatro" *Adone* VI, 140, 4), a point Accetto found to be true for everyone as a spectator "in this great theater of the world" ("spettator in questo gran teatro del mondo", Accetto XVII). Geographic knowledge and maps representing such knowledge, too, confirm existing correspondences between microcosm and macrocosm, as Ludovico Ariosto wrote that measuring and explaining lands, seas, and skies, in fact, meant to understand nature ("Alcun la terra e 'l mare e 'l ciel misura, / e render sa tutte le cause a pieno / d'ogni opra, d'ogni effetto di Natura, / e poggia sì ch'a Dio riguarda in seno" *Orlando Furioso* XLIII, 2, 1-4). In such universal views, everything exists within a hierarchy resembling the "staircase of nature" ("scala naturae"), in which Marino stated that stones were the lowest degree of matter, since "[air] has the power to move [everything else], otherwise even stones would be better than the sky."[193] In collections of remedies by Leonardo Fioravanti, Piero Bairo, and Isabella Cortese, the "marking in things" ("signatura rerum") was a trait allowing authors to find similarities with medical and human traits. Additionally, secret connections in natural elements were applied to medical therapy, so that affinities known as "sympatheia" renewed the belief than humans were microcosms benefitting from natural correspondences.[194] One such

[193] "Miglior foran del Ciel le pietre istesse, / se la forma motrice ei non avesse" (*Adone* X, 21, 7-8).
[194] "[…] ed osa poi di presagir l'occulto!" (X, 205, 7); "Cosa avenuta ei non capisce a pieno, / e quel ch'avenir deve, a spiar prende! / Non conosce se stesso, e quel che mira, / e del gran Giove ai chiusi arcani aspira" (X,

proximity is found, according to Marino, in palm-reading, closely related to astrology regarding human and celestial topics, harmony, so that there is affinity ("simpatia") between their mechanisms, up in the sky and low on Earth: "per la scambievole lega e rispondenza / ch'han le terrene e le celesti cose, / e per la simpatia bella che passa / tra la sovrana machina e la bassa" (XVI, 41, 1, 5-8).

The study of the night sky combines facts of astronomy ("astronomica scienza," XI, 202, 1) and notions of astrology to explain what happens in the sky and what consequences those motions cause, from above, in human lives. Marino, too, discussed the markings in things that are brought by cultural understandings of nature, and the importance of learning from portents, when a flower and a book show to be the same (VI, 139). Stars are "characters made of gold and of splendor" (VI, 138, 3-4), in terms similar to Galileo's Book of Nature metaphor.[195] Therefore, the flower where one finds symbolic traces from the Crucifixion is also, by way of metaphor, a book whose story is narrated through visual hints that the poet transformed into a narrative memory in poetry.[196] The beauty and complexity of the night sky are sometimes "transposed into Earth" ("Traslato è in terra il ciel" VIII, 83, 7), where a meaningful rhetorical phrasing arises questions in terms of style. The word "traslato" is both a past participle and a synonym for metaphors. Those rhetorical tropes move from one object, described in the poet's verses, to a concept, that is, a thought that someone conceived, according to Baroque rhetorical views (Tesauro 666-70). Additionally, there is a metonymic value by virtue of which the sky is

206, 5-8). Venus stated that "what is hidden, is consistent with, and corresponds / to what is beautiful outside, to see" ("[…] è conforme ancora, e corrisponde / al bello esteriore quel che s'asconde"; II, 122, 7-8).

[195] "In a small theater" ("in picciol teatro"; *Adone* VI, 140, 4).

[196] "Disse alcun, ch'a narrar le glorie e l'opre / del sempiterno lor sommo Fattore / le stelle, onde la Notte il manto copre, / son caratteri d'oro e di splendore. / Or miracoi maggior la terra scopre, / quasi bei fogli apre le foglie un Fiore, / Fiore, anzi libro, ove Gesú trafitto / con strane note il suo martirio ha scritto" (*Adone* VI, 138, 1-8).

representative of the earth, but also a highly symbolic marker of affinities in both terrestrial and celestial domains.

Conversely, poetry can report both fictional and factual contents through rhetorical devices: "as Poetry writes and sings, it collects at once the best of any science."[197] In Marino's words, literature allows time to flow infinitely, because in the written production of mankind is "the place where eternal eternity / writes others' memories in its book."[198] In this chapter, I have been examining both writings that claimed a new territory for the scientific genre, and writings that were meant as literary, while making science accessible through publications.[199] Marino's praise of Galileo as a versatile intellectual is unconditional, given his brilliant invention of the telescope, unknown at that time and brought to perfection by the scientist.[200] An unprecedented task, such as introducing a scientist like Galileo in a lyrical text, prompted Marino to present similes and personifications. Thus, Galileo is a novel Endymion, and a novel Columbus as well (*Adone* X, 43, 6-8; X, 45).[201] Marino's admiration for Galileo is expressed in several expressions, when he praised the telescope (X, 42), the scientist as a hero ("Tu, solo osservator d'ogni suo moto / e di qualunque ha in lei parte nascosta" X, 43, 5-6), and his book, the *Sidereus*

[197] "[…] la Poesia, che mentre scrive e canta / il fior d'ogni scienza insieme accoglie" (X, 139, 3-4).
[198] "[…] dove l'eternità che sempre vive / nel libro suo l'altrui memorie scrive" (IX, 58, 7-8).
[199] A distinction between accounts by experts and non-experts also inspires Chapter Four, in which I will consider both narrative medicine and medical narratives. Under those categories, I distinguish works written by physicians and works on medical matters written by non-health professionals. Similarly, mathematics, astronomy, physics, and biology had interested scientists and enthusiasts alike. Galileo distinguished between absolute truth in nature and ways to cope with natural anomalies in star movements "Scritture in difesa del sistema copernicano" (*OG* V, 349-70; particularly, 357-59). Thus, Ptolemy's preference for circles, epicycles, and concentric circles in cosmology reflects his philosophical views, whereas Copernicus considers Earth to be moving, and the Sun to be still as hypothesis to explain apparent paradoxes ("Veggiamo adesso tra quali spezie di ipotesi riponga il Copernico la mobilità della Terra e stabilità del Sole"). It is necessary to distinguish opinions of scholars based on their training, and to rank their mistakes accordingly, Galileo argued ("Questo che ne gli uomini non professori di queste scienze è molto scusabile, ne gli altri che le professassero darebbe indizio di non ben capire nè anco il significato de' termini eccentrico ed epiciclo").
[200] "Del Telescopio a questa etate ignoto / per te fia, Galileo, l'opra composta" (*Adone* X, 43, 1-2).
[201] "You, the only one who observed every motion of the Moon / and any part hidden in it."

Nuncius (X, 44-50). According to Marino, it is a poet's duty to write about new discoveries so that poems praise the discoverer and build historical memories for anyone reading the work later, it is assumed, "as I weave the famous facts of great Columbus, for future generations" ("mentr'io la chiara istoria in versi tesso del gran Colombo alle future genti" Lines 3-4; "il mondo novo" *Adone* X, 161, 6).[202] Struggles were unavoidable while Columbus sailed, so Galileo acted bravely as a "novel Tiphys," replicating the deeds of the Argonauts' helmsman Tiphys and discovering new celestial lights and new facts that were previously hidden to humans.[203]

Galileo's glory would be clear as his discoveries were, and he will live through that glory, so that stars will always speak of him, with beautiful, shining lights ("Chiara la gloria tua vivrà con esse, / e tu per fama in lor chiaro vivrai: / e con lingue di luce ardenti e belle / favelleran di te sempre le stelle" X, 47, 7-8). The metaphor is open to more than one reading, here, as Marino unveiled the concept of fame through stars as a metonymy and eponymy of his discoveries, but also with the action verb for stars: "favellare," "to talk, to tell stories," through which stars become fictional active agents in narrative science. Since stars are personified to speak of their discoverer, their acquired power is displayed through languages, or tongues that have celestial properties of light ("lingue di luce").[204]

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[202] Tommaso Stigliani wrote a poem on geographical discoveries, exploring metanarrative questions of authorship as it relates to the introduction of novelties in literature: "When writing *The New World*" ("Nel comporre il «mondo nuovo»"; *Lirici marinisti*, ed. Benedetto Croce. Bari: Laterza, 1910, vol. I: 7).

[203] "Aprendo il sen de l'Ocean profondo, / ma non senza periglio e senza guerra, / il Ligure Argonauta al basso mondo / scoprirà novo cielo e nova terra" (*Adone*, X, 45, 1-4); "Tu del ciel, non del mar Tifi secondo . . . senza alcun rischio, ad ogni gente ascose / scoprirai nove luci, e nove cose" (X, 45, 5-8).

[204] The closing line to Galileo's praise echoes the closing lines of each cantica of Dante's *Commedia*, just before Adonis resumes his adventures. See *Inferno* XXXIV, 139: "E quindi uscimmo a riveder le stelle"; *Purgatorio* XXIII, 145: "puro e disposto a salire a le stelle"; *Paradiso* XXXIII 145: "l'amor che move il sole e l'altre stelle." For theoretical reflections on stars in Dante's *Commedia*, see Piero Boitani, *Dante e le stelle*. Roma: Castelvecchi, 2017.

Marino's enthusiasm for science inspired poets who became his literary followers, the "Marinisti" who acknowledged the cultural debt and credit towards his poetry and innovations.[205] On one hand, Marino's celebrations could draw parallelisms between Columbus and Galileo, and Galileo and Tiphys. On the other hand, the poet also had a social role as a communicator, gaining authority through the message he conveyed.[206] In Marino's poem, first-hand experience, primarily through vision, allowed the fictional character of Adonis to understand reality and dispel any doubts. For example, Adonis tried to hold objects to learn about their material features ("just to know whether it is made of fire, or of gold"; "sol per saper se son di fuoco o d'oro" VI, 9, 7-8).[207]

Such quest for knowledge was expressed in idealized representations of knowledge that had been standardized in Cesare Ripa's collection of emblems, in which figurative knowledge is a personification. In Ripa's ideal, conceptual world, Knowledge is a woman whose right finger points to an open book next to her (*Iconologia, overo, Descrittione di*

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[205] In the poem, "To the Pen of Knight Marino" ("Alla penna del Cavalier Marino"), Girolamo Preti addressed the pen as a metonymy for writing and books, of the ideal model he looked up to, Giambattista Marino: "so, to make my pen (that is, my writing) sound like yours / I send modes, colors, and wits to you, / and my style only lives thanks to your wits" ("e, per far ch'ella sembri a te simile, / a te forme, colori e spirti involo / e de' tuoi spirti sol vive il mio stile"; Lines 12-14).

[206] Unlike Stigliani, Marino claimed that credibility increases for the writer who sings about science, and gives examples taken from trustworthy sources, so that writing about Galileo and his achievements (telescope, observations, and *Sidereus nuncius*) will benefit Marino as a poet and, furthermore, as a writer. For a comparison of Galileo to Columbus, see Andrea Battistini, "*Cedat, Columbus* e *Vicisti, Galilee*: due esploratori a confronto nell'immaginario barocco." *Annali d'italianistica* 10 (1992): 116-32, and Sergio Zatti, "Nuove terre, nuova scienza, nuova poesia: la profezia epica delle scoperte." *L'ombra del Tasso*, Milano, 1996: 146-207.

[207] Contrastingly, "pareidolia," the creative association between shapes and other things, seems to inspire Cesare Abbelli's poem, "Gli astri notturni." While he called stars in conventional poetic terms ("lampade amiche a' fortunati amori", Line 4), mental associations start, for him, when the feeling of greatness and void, inside and outside, induce him to speak to the stars ("Certo non è ch'in que' profondi orrori, / gli occhi rivolti al cielo, i' non favelle"; Lines 5-6). Consequently, his eyes follow the motions of the sky, imitating circles of stars ("Cosí, con nova idolatria, ne' giri / del cielo il bel di quel sembiante adoro, / favellando tra lor gli occhi e i sospiri", Lines 14-16 in *Lirici marinisti* 192). Scientific observations rely on senses, among which vision is possibly the main one. Marino acknowledged that, too: "your eyes, which now elevate themselves / above human, natural experiences" ("… l'occhio tuo, ch'ora si sublima / sovra l'umana e naturale usanza"; *Adone* II, 86, 5-6).

diuerse imagini cauate dall'antichità, & di propria inuentione. Roma: Lepido Facii, 1603: 71). In another edition of the same text by Ripa, Wisdom is an allegory both depicted in an engraved illustration and described as a textual allegory (Paolo Tozzi: Padova, 1611).[208] Wisdom holds a lit oil lamp in her right hand, as the light of the mind, and a book in her left, that Ripa described as the Bible, providing all necessary knowledge to save humans.[209] In the caption accompanying the illustration, she is a young woman who controls stars in the dark night, to receive comprehension of God's secrets.

[208] Fields of human knowledge had been explored by Marino as follows: "Azzion, passione, atto e potenza, / qualità, quantità mostra in ogni ente, / genere e specie, proprio e differenza, / relazion, sostanza ed accidente, / con qual legge Natura e previdenza / cria le cose e corrompe alternamente, / la materia, la forma, il tempo, il moto / dichiara, e 'l sito, e l'infinito, e 'l vóto" (*Adone* X, 131, 1-8).

[209] Ripa first published his emblem book of important symbols, *Iconologia*, in 1593 without illustrations. The second, illustrated edition of 1603 promptly became an essential source that warranted subsequent printings. https://www.metmuseum.org/art/collection/search/370219. For all editions of Ripa's work, see an online catalog project at Bergamo University (https://dinamico2.unibg.it/ripa-iconologia/edizioni.html#ed_04).

Figure 5. The personification of Wisdom from Cesare Ripa's *Iconologia* (1611). Photo Courtesy of Commons Wikimedia

For Marinisti, their field of expression would be "Poetry, writing and singing" that "picks the best of each science" ("la Poesia, che mentre scrive e canta / il fior d'ogni scienza insieme accoglie"; *Adone* X, 139, 3-4). Art wishes to mirror nature, as Marino himself admitted when he praised technological inventions ("astrolabi ed almanacchi . . . oriole"; *Adone* X, 136, 1 and 7). Marinisti described natural beauty, artworks, and inventions while showing connections among art, mechanics, and nature: clocks, quadrants, eyeglasses, and monocles, to mention a few of them. One common theme in poems by Marinisti is the study of astronomy because celestial motions allowed poets to write on aesthetic and science.

Observations, then, could be synesthetic for painters and astronomers who find their usual means of investigation mixed up because they share the same language and, above all, the same wonder.[210] For instance, in Pietro Michiele's poem "Alla notte," celestial spheres are conventional themes, inspired by Marino's imagery ("now here, or there contemplating, amazed, the starry ground and the flowering sky").[211] The transition between day and night, which was a poetical theme for descriptions and mythical references to Morpheus and the like, was also a hint to mention scientific instruments for Marino who remarked that "it was night when every thought has rest from its daytime motion… and the sundial gave way to the clock" ("Nott'era allor che dal diurno moto ha requie ogni pensier… e cedeva il quadrante all'oriolo" *Adone* XIII,34, 1, 4). To measure the passing of time, Girolami Preti wrote a poem on a clock, "L'oriuolo" and Lorenzo Casaburi one on a "stopped watch" ("L'orologio fermo"). Preti described a clock's mechanisms and practical uses, along with the classical theme of time's fugacity.

[210] See Enrico Berti, *In principio era la meraviglia*. Laterza: Roma-Bari, 2007.
[211] "[…] or quinci or quindi a contemplar rapito / il terreno stellato e 'l ciel fiorito" (*Adone* XV, 9, 7-8).

Mechanisms rotate and move in circular motions, as planets and stars do (9-16), and the inner motions of a clock also bear a resemblance to comets (40-41).[212] A shifting in appreciation of aesthetics and the value of human creativity occurred, from the artisanal object to the mass-produced scientific instruments that would later become common everyday objects.[213] Inventions and devices were reproducible, not unique as artworks or manuscripts be before the introduction of the printing press. In Marino's words, Time is personified through the instrument to measure it: "the great clock that turns around" keeps track of time. That is also our main way to detect the passing of time, thus the poet identified both the measurer and the measured value into the technological device. In addition to that identity, the watch turns around, as Earth does, both clock and planet having a similar circular shape ("grand'Oriuol che gira a tondo" *Adone* X, 22, 4). Planetary motions are so vast and impactful, that one can almost perceive their importance "with a sonorous vertigo" ("con sonora vertigine" X, 22, 7).

Aesthetic values seemed to change through a new appreciation of technology for Marinisti as well. Bernardo Morando's poem, "L'amante e gli occhiali" ("The beloved woman and glasses") and Giuseppe Artale's poem "La donna con gli occhiali" ("Woman with Glasses") are a parody of traditional poems about love, which the authors expressed

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[212] Celestial motions allow us to keep track of time since times immemorial. The act of measuring time is abstract, though. While we can see the passing of time through celestial motions of stars and planets, the act of noticing them is human. The act of determining those changes in position is celestial. A personification, thus, is introduced in the figure of an elderly man who is Time himself: "Measuring skies and stars, and a Chancellor of his holy decrees, an elderly man writes laws, and at his nudge everything has life, an elderly man writes in the great books of destiny" ("Misurator de' cieli e dele stelle / e Cancellier de' suoi decreti santi, / le leggi, al cui sol cenno il tutto vive, / ne' gran fasti del fato un veglio scrive"; *Adone* X, 50, 5-8). See G.J. Whitrow, *Time in History: The Evolution of Our General Awareness of Time and Temporal Perspective*. New York: Oxford University Press, 1989.

[213] Girolamo Preti, in "L'oriouolo," wrote: "Fabricando sonora e viva mole / arte si mosse ad emular natura, / ché, se diede natura il moto al sole / questa il moto del Sol segue e misura; / se eternamente il ciel girar si suole, / il giro anco di questa eterno dura, / e ciò che faccia il Sol, nasca o tramonte, mostra, / nunzia fedele, in voce e 'n fronte"; Lines 1-8.

through new common objects such as eyeglasses. For Morando, eyeglasses are "spherical crystals" ("sferici cristalli" 1) that he must wear after being baffled by the woman's beauty, but he had the vision of a lynx earlier, which is possibly an allusion to scientific affiliations to the Accademia dei Lincei ("Fui lince pria" 5).[214] Artale's beloved woman needs glasses, instead: "obscured snows," "two glass lenses" ("nevi addensate" and "due vetri" 1; 6) to keep a distance from the men she is seducing (1-4). Therefore, the poet believed she is comparable to Archimedes, the scientist who would have used burning mirrors in war, the same way she uses her glasses searching for love ("Ella, quasi Archimede, arder noi vuole . . . benda ha di vetri"; Lines 9; 14). In another poem by Giacomo Lubrano, "The small lens" ("L'occhialino"), ambivalent feelings are shown for empowered vision, exaggerated hopes in technology, and a general sense of life's caducity ("Con qual magia di cristallina lente, / picciolo ordigno, iperbole degli occhi" Lines 1-2).

Ordinary, routine items supplied topics for poems in the early modern period. Giuseppe Battista wrote a poem on water, "L'acqua." Ciro di Pers wrote about a skein-winder ("La dipanatrice"), a hunter with an arquebus ("Il cacciatore d'archibugio"), a clock ("L'orologio da ruote"), and an earthquake ("Il terremoto") that one can explain "not in bottled steam, not a trident one might have seen in a dream" ("Non è chiuso vapor, come

[214] The reference to the vision of a lynx is also allusive of the Accademia dei Lincei. On connections between vision and science, Baffetti noted that "[…] come nel grande modello platonico la dialettica è insieme metodo d'indagine e forma del sapere, che non è un dato, ma un'esperienza che si costruisce progressivamente attraverso un lungo e paziente dialogo: da una parte, per tornare all'immagine di Galileo, il 'libro della natura scritto in lingua matematica' e dall'altra gli 'occhi', lo sguardo curioso dell'osservatore che interroga e interpreta. È evidente, del resto, che l'idea del 'libro della natura' presuppone una prospettiva ermeneutica. Non è semplicemente una metafora: lo sguardo del lettore scienziato del libro della natura, al pari di quello del lettore filologo del libro tradizionale della cultura, deve essere quello di un interprete esperto, nel senso letterale di colui che ha fatto esperienza" (Baffetti 504-05). See also Richard S. Westfall, "Galileo and the Accademia dei Lincei." In *Novità celesti e crisi del sapere*, ed. Paolo Galluzzi, 189-200. Florence: Giunti Barbera, 1984; David Freedberg, *Eye of the Lynx: Galileo, His Friends, and the Beginnings of Modern Natural History*. Chicago: University of Chicago Press, 2010.

altri crede, / né sognato tridente"; lines 3-4). The scientific explanation endorsed by Ciro di Pers "is the language of the sky that emulates the thunders and lightnings. Now the Earth speaks in horrible notes." The Book of Nature imagery became vocal, from his perspective, when "man, who wants to be all earthly, and cannot understand the foreign language of the sky, might at least understand the language of the Earth."[215] Some poets even criticized some inventions, for example weapons, as did Giuseppe Battista in his poem "Lo schioppo" where he described "the war-related work produced by the Germans, . . . with nitrous sulphurs" ("di man germana opra guerriera, / di zolfi nitrosi").[216]

Natural phenomena in astronomy were often discussed as new discoveries made possible through the telescope. Lunar features are discussed because spots appearing on the Moon's surface ("D'alcune ombrose macchie impressa io veggio", *Adone* X, 34, 1) were a question posed by Marino that had been debated among philosophers, some of whom brought up the fact that spots might depend on the one side of the Moon that we can

[215] "È linguaggio del ciel che ne riprende / il turbo, il tuono, il fulmine, il baleno; / or parla anco la terra in note orrende, / perché l'uom, ch'esser vuol tutto terreno, / né del cielo il parlar straniero intende, / il parlar della terra intenda almeno" (Lines 9-14). Similar tones were present in Giuseppe Artale's poem for the Ragusa earthquake, "Il terremoto di Ragusa"). Artale stated that the Earth is at the center of the universe: "Circonferenza il ciel, punto inchiodato / la terra è in centro, e pur tremar la sento"; Lines 1-2. Such position was published in 1672 in Naples, a cultural center of academies, thus showing diverse subscriptions of science-enthusiasts to Ptolemaic or Copernican cosmologies. Giambattista Basile, the author of *Pentamerone*, also wrote a poem, entitled "For Mount Vesuvius' eruption in 1632" ("Per l'incendio del Vesuvio del 1632"), in which he described a personified Vesuvius giving birth to lava ("Mentre d'ampia voragine tonante / fervido vedi uscir parto mal nato, / piover le pietre e grandinar le piante, / spinte al furor d'impetuoso fiato"). Another scientific theme, the regular passing of time, was described by Ciro di Pers as a "fine instrument with dented wheels, breaks into daytime and divides it into hours . . . as it hits the hollow metal . . . and with those percussions, the metal resonates" ("Nobile ordigno di dentate rote / lacera il giorno e lo divide in ore . . . Mentre il metallo concavo percuote . . . E con que' colpi onde 'l metal rimbomba"; Lines 1-2; 5; 12).

[216] Regarding the variety and dangers of weapons denounced by Ariosto (*Orlando Furioso* X, 90-91), alongside with "the destruction of chivalric values," Bolzoni maintained that "[…] in the impassionate denunciation the distance between history and fiction is reduced, so much so that probably never does a character of the poem pronounce the words of the poet so exactly to the letter" (Bolzoni 281). Firearms would also be the opposite, infernal counterpart of God's creation of lightning bolts. Marino, too, had discussed wars: for example, in the proem of canto XIV, in terms of "decadence in military practices" (Bolzoni 287).

see from Earth (35; 36).[217] Mountains, too, could be the reason for darker spots visible on the Moon ("col suo reverbero venisse / l'ombra de le montagne", X, 38, 3-4, and 41). The Moon (now called a celestial body, "pianeta" in X, 39, 1) is not polished and plain, and has valleys and cliffs, as the Earth does."[218] Those statements (*Adone* X, 39-40) summarize Galileo's findings in *Sidereus Nuncius*, according to which the Moon has valleys and mountains, lunar spots, and areas in darkness that resemble the area and borders of Bohemia in a map of Europe. Therefore, the Moon is no more extraordinary than Earth – with implications of criticism against Aristotelian theories of eerie celestial bodies (*Sidereus Nuncius* 11r). The surface of the Moon is "like Earth itself" ("come la terra istessa", *Adone* X, 40, 2). If Earth and Moon look alike, life could be present there, given the presence of "other seas, rivers, and springs, but also cities, kingdoms, provinces, plains, and mountains."[219]

Irregularities on the lunar surface confused observers, and Marino wrote about their likely causes in ten stanzas, before introducing Galileo by his invention, the telescope (X,

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[217] Today, approximately thirty craters on the Moon are named after Jesuit astronomers. In addition to the Moon, human perspectives on astronomical matters inspired Marino to show how Venus is visible as it is, to those who observe the planet from Earth: "Questo l'avien non sol perché minore / de l'altre erranti e de le fisse è molto, / ma però che da luce assai maggiore / l'è spesso il lume innecclissato e tolto. / Sotto i raggi del Sole il suo splendore / nasconde sì, che vi riman sepolto, / e tra que' lampi onde si copre e vela, / quasi in lucida nebbia, altrui si cela" (*Adone* X, 110, 1-8). Additionally, according to Marino, the Moon would influence not only living beings, but also inert matter, imparting "the power of motion, and also motion, when [the Moon] wanes and waxes" ("prendon da questa ogni virtú motrice, / e 'l moto ancor, quand'ella manca o cresce" (*Adone* X, 30, 3-4).

[218] "[…] non è (com'altri vuol) polito e piano, / ma ne' recessi suoi profondi e cupi / ha non men che la terra, e valli e rupi" (*Adone* X, 39, 6-8).

[219] "[…] altri mari, altri fiumi, ed altri fonti, / città, regni, provincie, e piani, e monti" (*Adone* X, 40, 7-8). There were concerns regarding the possibility of extraterrestrial life, in astronomy and astrobiology, among Church members at Galileo's time. If celestial bodies were hospitable to life, would those beings come from Adam, or were they affected by the Genesis flood? Most importantly, were they saved by Jesus Christ? Currently, the Specola Vaticana continues pursuing investigations on extraterrestrial life. See the interview to Father Funes, Director of the Specola Vaticana and a Jesuit himself, in Francesco M. Valiante, "L'extraterrestre è mio fratello." *L'Osservatore Romano*, 14 May 2008). Jesuit Father Consolmagno, formerly at NASA, wrote a book on salvation and extraterrestrial life: Guy Consolmagno, Paul Mueller, and Daniela M. Rossi. *Battezzeresti un extraterrestre? e altre domande tra scienza e fede poste all'Osservatorio Astronomico Vaticano* (Milano: Rizzoli, 2018).

33-42). Marino praised Galileo, particularly in canto X, and he anticipated, in prophetic tones, that Galileo would "discover new lights and new things that were hidden before, without any risk, for every nation to know," thus acting as a "measurer of heavens and stars" ("senza alcun rischio, ad ogni gente ascose / scoprirai nove luci e nove cose" and "Misurator de' cieli e dele stelle", *Adone* X, 45, 7-8 and X, 50, 5).[220] The god Mercury foretold the invention of the telescope, anticipating the awe and wonder of Galileo's supporters. Thanks to Galileo, the features of the Moon will be known clearly ("senza impedimento" 42, 1; "queste sue note ancor fien note e chiare" 42, 2). His remarkable instrument, the telescope, could make items far away appear to be closer ("mercé d'un ammirabile stromento / per cui ciò ch'è lontan, vicino appare" 42, 3-4). The telescope, a small tube with two lenses made of glass ("per un picciol cannone e duo cristalli" 42, 8; "the fragile glass of your moon-shaped lenses"; "de le tue lunette il vetro frale" X, 46, 7) is available to anyone who keeps one eye next to the instrument lens, while closing the other eye ("e con un occhio chiuso e l'altro intento / specolando ciascun l'orbe lunare" 42, 5-6), in order to make great distances negligible ("scorciar potrá lunghissimi intervalli" 42, 7). The ambition of scientists is "to seek new lands and new things" ("a cercar nove terre e nove cose" IX, 73, 8), and science resembles to a new path to discover.[221] As I mentioned

[220] Giovanni Getto and Giuseppe Giudo Ferrero studied Baroque prose and poetry and established historical perspectives in Italian Studies. "Dinanzi alle scoperte e alle invenzioni della scienza (nell'età di Galileo!) i rimatori barocchi manifestarono uno stupore ammirativo che è più spesso di maniera. Ma più schietto e artisticamente fecondo è il loro interesse per certi aspetti minori della tecnica antica e recente e per le arti manuali dove l'ingegnosità umana faccia buona prova… spesso la parte più vitale di quelle rime è l'indugio descrittivo. E d'altro lato, è evidente nella poesia barocca il gusto d'una varia e copiosa nomenclatura: nomi e virtù delle piante, delle erbe, dei fiori, degli animali, delle pietre preziose, termini geografici e tecnici; che ci richiamano più o meno indietro nel tempo, alla *Naturalis historia* di Plinio, ai lapidari e ai bestiari medievali, ai trattati di 'filosofia naturale' e di medicina del '500; e infine (è quel che più ci interessa qui) alla poesia didascalica del Rinascimento" (Giuseppe Guido Ferrero, Introduzione a *Marino e i Marinisti*, Milano: Ricciardi, 1954, accessed online).

[221] Anticipations of the discovery of the Americas came from Fortune's prophecies in *Orlando Furioso* XV, 28. See Bolzoni 284.

earlier, scientists were compared to explorers, and Galileo would be a new Columbus, Tiphys, or Icarus (XI, 193, 1-8). Newly found lands are also open to the experience of those who do not travel, through their experience reading poems and, hopefully, the Book of Nature metaphor and the guidelines it sets for curious observers. In terms of wonders and geographic explorations, the Book of Nature metaphor was rephrased in geospatial terms by Federico Meninni in his poem, "The Map" ("La carta geografica").[222] In it, the author represented maps as complex representations that are comparable to books whose texts provides readers with complete knowledge.[223]

Another form of natural representations is, for Marino, pictorial. The poet considered painting to be the closest imitation of nature, since "Nature seems to have devoted every energy to painting, to win over Art" ("par che per vincer l'Arte abbia Natura / applicato ogni studio ala pittura"; *Adone* VI, 109, 7-8). Thus, "in a way, Nature competes against Art" ("quasi in gara con l'Arte entrar Natura" VI, 134, 2). The result of that competition between the two personified rivals, Nature and Art, does not defeat either, and the outcome, instead, is a "portent and marvel of Nature" ("di natura Portento e meraviglia" VI, 137, 3). Marvels were also called items that wealthy patrons collected in cabinets of curiosities, known in German as 'Wunderkammern.'[224] Resemblances between a model and a painting, according to Sperone Speroni, would also be present in translations, for example between a text of philosophy in the original language, likely Greek or Latin, and

[222] "Forza d'umano ingegno! In breve giro / Europa tutta epilogata io trovo; / per sentier sconosciuto il piè non movo, / e pur straniere io le città rimiro. / Quanto in piú lustri altri mirò, se giro / un sol guardo, distinto io tutto approvo" (Lines 1-6). "Stupor non fia se de l'argiva musa / fu l'Iliade ristretta in una noce, / quando l'Europa in picciol foglio è chiusa" (Lines 13-14, in *I lirici marinisti* 488).
[223] "[…] the name of one Athens, written on a small museum," that is a book on a land he has not visited ("e d'una Atene, a risvegliar la mente, / scritto in picciol museo contemplo il nome" (Lines 7-8).
[224] See the 2019-2020 exhibition at the Metropolitan Museum of New York City: "Making Marvels: Science and Splendor at the Courts of Europe" (https://www.metmuseum.org/exhibitions/listings/2019/making-marvels-science-splendor).

its translation into a current vernacular, which he believed is "the replication of the ancient one." Regardless of how skilled the painter (and translator) could be, the result might be misleading, though, as readers can be "confused by the charm of words" (*Dialogo delle lingue* 113-14).[225]

In addition to astronomical wonders, rainbows were often debated as natural wonders in scientific and literary texts. Marino wrote that "an arch-like shape impresses into the sky rainbows, as it raises up [into the sky], thus provoking wonder" ("Meraviglia talora, mentre s'estolle, / arco stampa nel ciel simili ad iri"; *Adone* IX, 108, 1-2). The painter Apelles is "god-like" in coloring up the rainbow, and observers would love to learn how it rains, how Earth is still, and how skies and stars rotate ("come immota è la terra, il ciel si move, / e per lo molle ciel guizzan le stelle, / sol mi reputo inferiore a Giove," Lines 12-14).[226] Because books are important carriers of meaning, Adonis admitted to "unveil happily what you say, with great attention, and then reveal your theories to people" ("A quanto dite voi l'orecchie intente / con diletto disserro, e poi rivelo / io le vostre dottrine ad altra gente," Lines 9-11). One author discussing rainbows was Camilla Erculiani, a pharmacist from Padua who wrote "Letters on Natural Philosophy" (*Lettere di philosophia*

[225] Speroni explored analogies between originals and copies, and he wrote as follows: "Onde seguendo l'altrui giudizio; altra cosa non viene ad essere questa moderna Filosofia, che ritratto di quell'antica. Però cosí come il ritratto, quantunque fato d'artificiosissimo dipintore, non può esser del tutto simile all'idea; cosi noi, benché forse per altezza d'ingegno non siamo punto inferiori a gli antichi, nondimeno in dottrina tanto siamo minori, quanto lungo tempo stati sviati dietro alle favole delle parole." In artistic terms, Stigliani's poem "The Portrait" ("Il ritratto") acknowledged a resemblance between the portrait of a woman, which still differs from nature itself ("Ben si somiglia in parte, / Arpin, la tua pittura / a costei; ma può l'arte / mal giunger la natura," Lines 1-4). Not only there is a gap between a painting and reality, which is assigned the value of truth ("'l vero"), but there is also another difference between a work and the thoughts presiding and guiding its author ("Sempre resta minor l'ombra che 'l vero, e sempre cede l'opera al pensiero," Lines 5-6). Resemblances are, at times, guessed, for example when Mercury tells Adonis that he could "see every though painted in your forehead, clearer than if you had enunciated it in your words" ("ti veggio in fronte ogni pensiero dipinto / più' che se per parlar fosse distinto," *Adone* X, 25, 7-8).

[226] In his poem "Lo studio delle lettere" ("Studying the Humanities"), Giuseppe Battista wanted to "understand how a painter can color up a rainbow, and how it rains from the sky, how the Earth is still, and the skies move, how stars sparkle in the beautiful sky" (*I lirici marinisti* 431).

naturale), published in Krakow by an unknown printer in 1584. The author was afterwards tried by the Inquisition, though the reasons and results are not fully known. Erculiani discussed natural phenomena as the starting point for complex observations on the structure of nature, and her book was not explored until recent studies by Eleonora Carinci and by Hannah Marcus.

At a theoretical level, marvels are the emotional response to human curiosity, and they promote more curiosity because "curiosity convinces them" (". . . la curiosità gli persuade," *Adone* II, 119, 8). That approach was heralded by the apologue on sounds, in *The Assayer*, but also in Marino's poem, *Adone*, to "bring to the fore the marvels of vast knowledge / please, of the topic you so greatly care about" ("fa' (prego) in cosa ov'hai tanto interesse, / del gran sapere le meraviglie espresse," *Adone* I, 75, 7-8). Marvel oftentimes is a visual or auditive experience, so that Adonis finds his eyes captured by pleasant views of objects heretofore unknown: "thus, turning his eyes, astonished, to those pelasant items, that he had not seen before, Adonis, entering those walls, is marveling, not without much pleasure" ("così volgendo ai dilettosi oggetti, / novi al suo senso, attonito le ciglia, / entrato il bell'Adon tra que' ricetti, / non senza alto piacer si meraviglia"; XI, 25, 1-4). The verb to repeat observations on natural phenomena, "ti narri" (VII, 58, 4), is the verb for fiction and for epic, through storytelling.

Philosophical themes on knowledge are a topic of interest that found expression particularly in poetry. Adonis asked to narrate the origin of such knowledge, "where . . . and how" it was acquired ("onde l'apprese e 'n qual maniera"; VII, 58, 4), or in other terms, "the very first origin, and in which way" ("l'origin prima e 'n qual maniera" II, 41, 2; "Dica costei che 'l sa, costei che 'l sente, / di questa invenzione l'origin vera" VII, 58, 1-2). Those

scientific poems on science are factual, and on such premises, it is argued here, narration and storytelling are leading rhetorical techniques to discuss science in the early modern period. By writing about discoveries, poets become public writers who became involved in current events and served the community of contemporary readers, and further on in the years, to serve learning needs in historical views, as said at the end of Stigliani's poem: "one who does not waste time being unproductive and lazy, one who instead works hard for public good" ("… un che non la consuma in ozio cheto, ma per publico pro l'usa e fatica," Lines 10-11).

While prose prevailed for scientific themes, poetical renderings existed alongside prose, both in the form of celebratory writing and in didactic form. Poetical narrations at times hide a secret meaning, but they also show how "truth is overwhelmed by shadows" ("'l ver dal'ombra è vinto"; *Adone* VI, 51, 6).[227] With those aesthetic and philosophical notes in mind, a painter's, or a poet's, gaze is not objective. The Book of Nature metaphor is akin to other systematic concepts that scholars introduced in the sixteenth century, the structure ("fabrica") being one of them.[228] The representation of nature is possible through

[227] For statements on nature are always presented in the same way in the Bible and Fathers of the Church had maintained in their interpretations ("quelle proposizioni naturali… intese conforme al nudo significato delle parole, senza glose o interpretazioni, e ricevute e tenute per verissime" *OG* V, 330-33). Galileo referred to the motion of the Sun and the stillness of Earth based on scientific principles. Where science is powerless, then one should subscribe to the Bible only ("dove gli umani discorsi non possono arrivare, e che di esse per consequenza non si può avere scienza, ma solamente opinione e fede, piamente convenga conformarsi assolutamente col puro senso della Scrittura"). Science and theology can present contrasting views on nature, but nature and spirituality are both true, so their contents cannot contradict each other, thus founding his reasoning on Saint Augustine's theory of adaptation of classical thought and complex concepts to Christian beliefs and doctrines ("[…] accertarsi del fatto, il quale ci scorgerebbe al ritrovamento de' veri sensi delle Scritture, li quali assolutamente si troverebbono concordi col fatto dimostrato, ben che le parole nel primo aspetto sonassero altramente; poi che due veri non possono mai contrariarsi"). Cultural relativism is particularly evident on aspects that do not relate to souls' salvation ("nelle cose non necessarie alla beatitudine più si accommodorno all'uso ricevuto che alla essenza del fatto").

[228] In Speroni's dialogue on languages, Perotti stated that Aristotle's ideas do not reside in the Greek alphabet, so that collecting parts of a classical language does not bring those fragments to a vital unity. Collecting parts, even with the help of the god of medicine, Asclepius, would not bring those elements to a renewed life ("[…] che a dovere farsi philosophi basti loro sapere scrivere, et leggere greco senza più: non altramente, che se lo

artistic renditions, with painting as privileged means of capturing nature ("Ahi! qual pennello in te dolce e pietoso / trattò la man del gran pittore eterno?"; *Adone* VI, 141, 1-2). The history of scientific methods started around discussions on the Book of Nature metaphor, with technological inventions, theaters, and maps displaying examples of knowledge helpful to promote the public circulation of new ideas on nature.

spirito d'Aristotele, a guisa di folletto in cristallo, stesse rinchiuso nell'alfabeto di Grecia: et con lui insieme fosse costretto a entrar loro nell'intelletto a fargli propheti… considerando che 'l vostro scrivere latino non è altro, che un andare ricogliendo per quest'auttore, et per quello, hora un nome, hora un verbo, hora un adverbo della sua lingua: il che facendo, se voi sperate (quasi nuovo Esculapio) che il porre insieme cotti fragmenti possa farla risuscitare, voi v'ingannate… onde minore, et men ferma rifarete la fabrica, ch'ella non era da prima… se voglia vi verrà mai di comporre o canzoni; o novelle al modo vostro, cioè in lingua, che sia diversa dalla Thoscana, et senza imitare il Petrarca, o il Boccaccio; per avventura voi sarete buon cortigiano, ma poeta, o oratore non mai" (*Dialogo delle lingue* 118-20). The idea of body parts as elements of a language resonates with the reference to the devotional caution towards classical languages, comparable to a religious awe towards relics. On those foundations, discussions on the biopolitics of language will follow in Chapter Four regarding epidemic outbreaks, public health, and personal perceptions of wellbeing.

6. Circulating Scientific Experiences.

After discussing the role of the scientists as discoverers, what could the reception of their work be among readers and students in their classes? The poet Marino drew attention to novelties, marvels, and the feeling of wonder at their sight, experience, or retelling. Understanding the deepest reason ("l'alta cagione"; *Adone* X, 33, 5) is an effort comparable to a desire of knowledge. Once eyes perceive one phenomenon, the curious observer of nature can express doubts ("D'una cosa a spiar l'alta cagione / caldo mi move e fervido desire, / cosa che da che pria l'occhio la scorse, / sempre ha la mente mia tenuta in forse"; X, 33, 5-8) without finding secure opinions ("Dimmi il perché; tra mille dubbi ondeggio, / né so trovarne opinion secura"; X, 34, 3-4). From those lyrical lines, there emerged a steady appreciation of books as symbols of culture.[229]

After the 1604 Nova investigations, Galileo became interested in the phases of Venus, which resembled the Moon's variable surface, as seen from Earth.[230] Galileo's first letter on sunspots pinpointed another unexpected irregularity that could not fit in a geocentric universe. Sharing scientific discoveries became more than a matter of authority, so that it was a scientist's responsibility to be acknowledged as a discoverer and to publish results.[231] Furthermore, Galileo committed to advocating Copernican astronomy. His

[229] Bolzoni argued that Orlando's attempt to indoctrinate Agricane through the contemplation of the night sky failed (XVII, 41), revealing different values in the two knights, not only in terms of religion, but, importantly, "the value, or lack of value, accorded to books, to learning" (Bolzoni 274).

[230] Strong opinions circulated particularly for Venus: "[…] in case Saturn or Mars approach her (Venus) with bad looks, contaminating her light and sharing some flaws among their bad qualities. When, however, it happens that (Venus) stands high, far from an evil look, then one cannot say with how many effects, and how good, she can make someone's birth lucky" ("Egli è ben ver, che se Saturno o Marte / a lei s'accosta con obliquo aspetto, / le contamina il lume e le comparte / di sua rea qualitá qualche difetto. / Ma quando avien che 'n elevata parte / lunge da sguardo infausto abbia ricetto, / non si può dir con quanti effetti e quali / fortunati suol far gli altrui natali," *Adone* XI, 16, 1-8).

[231] On Galileo's studies of Saturn, see Albert Van Helden, "Saturn and His Anses." *Journal for the History of Astronomy* 5.2 (1974): 105-21, and "*Anulo cingitur*: The Solution of the Problem of Saturn." *Journal for the History of Astronomy* 5.3 (1974): 155-74.

former student, Benedetto Castelli, had introduced Galileo to Copernicus's book, *On the Revolutions of the Heavenly Spheres* (1543). The astronomer Copernicus had dedicated his book to Pope Paul III, disregarding those who criticized his work without being qualified.[232] Thus, a maxim from the foreword by Andreas Osiander to the book became a guideline for the new scientific books: "mathematics is written for mathematicians," or in Edward Rosen's translation, "astronomy is written for astronomers."[233]

The study of heavens had implied astronomy as well as astrology, for both of which the Latin word "astronomia" had been used in classical and medieval times.[234] Astronomy and astrology were interchangeable terms, in Marino's poem.[235] What does the word "nature" mean, scientists wondered?[236] Articulating meaning is important to capture those

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[232] Copernicus studied astronomy as he attempted to adjust the calendar, in particular the calculation of Easter; the 1582 reform of the calendar had been promoted by Pope Gregorius XIII and completed by Christopher Clavius, a Jesuit, among others. For contexts and details of international followers of Copernican theories, see Aviva Rothman, "Forms of Persuasion: Kepler, Galileo, and the Dissemination of Copernicanism." *Journal of the History of Astronomy* 40.4 (2009): 403-19.

[233] The Latin text of Copernicus' preface was written by Osiander, though, as a defense against allegations of possible heresy for the astronomical texts. In terms of methods, he wrote that: "Mathemata mathematicis scribuntur." "Mathematicus" meant astrologer; the word for mathematics as we mean it, instead, was "geometry." See *Codex Justinianeus*: "De maleficiis et mathematicis et ceteris similibus" (9.18.0); "Ars autem mathematica damnabilis interdicta est omnino," and "Artem geometriae discerearque exercere publice interest" (9.18.2). Roman laws allowed the study of geometry to avoid potential conflicts with magical thinking. See Gino Loria, "Sketch of the Origin and Development of Geometry Prior to 1850," *The Monist* XIII, 1 (1902): 80-102.

[234] The Book of Nature concurs with the book of philosophy and the book of theology in Galileo's writings, and early modern readers could not part ways with the book of theology and the book of philosophy necessary to interpret it. In the famous letter to Father Castelli, Galileo had remarked that people receive intellect from God ("che quel medesimo Dio che ci ha dotati di sensi, di discorso e d'intelletto, abbia volute, posponendo l'uso di questi, darci con altro mezzo le notizie che per quelli possiamo conseguire, non penso che sia necessario il crederlo, e massime in quelle scienze delle quali una minima particella e in conclusioni divise se ne legge nella Scrittura"). The debate was eventually settled in Pope Paul VI's *Dei Verbum* as the Second Vatican Council's Dogmatic Constitution on Divine Revelation (18 November, 1965).

[235] "Non può dunque astronomica scienza, / né specolazion di mente inferma" (*Adone* X, 202, 1-2). The two disciplines give, respectively, "securo presagio" and "sentenza / de l'avenir determinata e ferma" (X, 202, 2-3), but oftentimes there are wrong predictions: "del suo saver la conoscenza / è general, che spesso il falso afferma" (X, 202, 5-6). Furthermore, Marino's personification of Wisdom is described as follows: "Quella è Sofia, che rabbuffata i crini, / magra, e con guance pallide e distrutte, / con scalzi piedi e con squarciati panni, / pur di dotti scolari empie gli scanni" (X, 130, 5-8).

[236] According to the entry in *Vocabolario dell'Accademia della Crusca*, s.v 'natura': "Voce comunissima, che abbraccia tutte le forme delle cose, quanto l'essenze, e le cagioni, onde si dice. Natura principio del moto, e della quiete, e anche ordine divino, per loquale tutte le cose si muovono, e nascono, e muoiono. Lat. *Natura*"

ideas because that would be essential "in a language that humans speak, one does not need teachers or schools" ("con lingua umana articolar sermone, / maestro qui non si richiede o scola"; *Adone* VII, 25, 2-3). A scientist who sees a design, along with patterns in nature, does not need teleology to justify scientific research because both Nature and the First Mobile do not cause anything to happen without a reason ("perché Natura e 'l gran Motor sovrano / nulla giá mai nel mondo oprano invano"; XV, 44, 8).

The central presence of nature in the Book of Nature metaphor opens specific case studies in astronomy and the applied support of physics. In addition to his many books in prose, Galileo wrote a sonnet titled "Enimma" ("Enigma") that provides a powerful example of narrative modes, prose, and secrecy related to scientific discoveries. That poem reads as follows:

> Mostro son'io più strano e più diforme
> Che l'Arpía, la Sirena o la Chimera;
> Né in terra, in aria, in acqua è alcuna fiera,
> Ch'abbia di membra così varie forme;
> Parte a parte non ho che sia conforme,
> Più che s'una sia bianca e l'altra nera;
> Spesso di cacciator dietro ho una schiera,
> Che de' miei piè van rintracciando l'orme.
> Nelle tenebre oscure è il mio soggiorno,
> Che se dall'ombre al chiaro lume passo,
> Tosto l'alma da me sen fugge, come
> Sen fugge il sogno all'apparir del giorno,
> E le mie membra disunite lasso,
> E l'esser perdo con la vita, e il nome.

The first-person narrator of this poem is mysterious, without a name. A self-description follows, delineating a mysterious object that constitutes an enigma. As a personification, it speaks of its own mismatched, black, and white limbs, but also its work and routine, with

(second edition, 538). In the third edition of the *Crusca* dictionary (Vol. 3, 1076), the definition only differs by the addition of the Greek word, "physis."

hunters tracing the tracks of its feet, and finally the threat of an end to its life, passing from shadows to bright light.

The first-person narrator is a telescope.[237] The metaphor of light had been used by Speroni for Lascaris' argument in favor of *Cratylus*, a dialogue by Plato on language and languages: "one could say that such language is like a light to colors is for disciplines: without that light, our human comprehension would see nothing, sleeping an endless night of ignorance" (*Dialogo delle lingue* 114-15).[238] The poem by Galileo celebrates the scientific instrument as an astronomical and anatomical object, in lyrical tones and humanistic conventions of a sonnet.

The poem "Enimma" explored scientific topics, particularly telescopes as scientific instruments. Galileo's poem was the response to a sonnet by Antonio Malatesti on the telescope.[239] Malatesti was the author of *La Sfinge, enimmi* ("The sphynx, enigmas." Venice, 1640).[240] The mechanisms of the telescope, and how it works, are an enigma, while its description in words is a riddle.[241] Without referring directly to their topics, enigmatic

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[237] Malatesti's work gave Galileo the opportunity to contribute to a literary debate about the use of enigmas in the Academy of the Dispassionates ("Accademia degli Apatisti") in Florence, founded only a few years earlier by a group of intellectuals interested in science, literature, and art (1635), and protected by Cosimo III Medici since 1639. See Edoardo Benvenuti, *Agostino Coltellini e l'Accademia degli Apatisti a Firenze*. Pistoia: Officina tipografica cooperativa, 1910.

[238] "Si può dire di tal lingua, che quale è il lume a colori, tale ella sia alle discipline: senza il cui lume nulla vedrebbe il nostro umano intelletto; ma in continua notte d'ignorantia si dormirebbe."

[239] Scholars suggested that the publication of Galileo's poem as a form of enigma in itself was somehow intended to follow his death (Marcus and Findlen 988). Galileo's poetic enigma first appeared in print in the expanded edition of *La Sfinge* published by the Grand Ducal press in 1643.

[240] The Veronese riddle (*Indovinello veronese*) is possibly the earliest example of a riddle in the Italian vernacular: "In a manuscript of the eighth or ninth century, preserved at Verona (a Mozarabic prayer book), the following notation was discovered in 1924: 'Se pareba boves alba pratalia araba et alba versorio teneba et negro semen seminaba'; that is, 'He urged on the oxen, ploughed white fields, held a white plough, and sowed black seed'" (Curtius 314).

[241] Galileo actually never explained precise details in physical properties for the telescope. Likely, he did not withhold the information on purpose; instead, he would have understood the instrument, enough to build and adjust telescopes, but was not confident enough to teach it. Kepler continued what he saw as a mission of scientific inquiry and a divine investigation of nature, writing the book *Dioptrice* ("Dioptrics," 1611), in which he delineated a theory of the telescope.

references might puzzle and interest readers, and produce a feeling of wonder. Was there a desire for anonymity? Was the riddle supposed to conceal the spoliation of scientific insignia that Galileo had assumed? If the telescope loses its being, liveliness, and name, it experiences a passage from shadows to light that seems to correspond to moving from a Socratic awareness of ignorance, to the knowledge that science provides. At the same time, the scarcity of light in which a telescope works supports secrecy and a sense of safety that is lost with the exposure to light. Light, instead, unveils and reveals the speaking mysterious entity, that is the telescope, and so the namesake enigma vanishes once light is cast upon the riddle itself, and the poem ends.[242] The challenge is gone for hunters tracking the telescope's traces. Readers move past the riddle, as they discover, in a telescope, a mix of mismatched limbs and the resulting beast and monster, in the Latin-derived, etymological sense of prodigy and portent, without equals "on land, air, and water" (Line 3), and the moral of the poem encourages us to be readers and curious thinkers at the same time.[243] Finding an answer to the riddle, by giving it a name, as alluded in the last line of the poem, dispels the enigma that was there to solve, so that the playful elements contribute to mystery and witticisms.

Names for the telescope ranged from "canna," "occhiale," "cannocchiale," and "telescopio" as a Greek-derived word.[244] Additionally, "lente" and its plural "lenti" were

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[242] The play on opposites and the effect of novelty that creates, is also exploited in the movie *La vita è bella* ("Life is Beautiful", directed by Roberto Benigni, 1998) when Dr. Lessing poses some riddles ("indovinelli") for Guido; for example, "Più è grande e meno si vede" is "L'oscurità", and also "Se fai il mio nome non ci sono più, chi sono?" and "Il silenzio" was its answer and solution.

[243] See Marjorie Nicolson, "The Telescope and Imagination." *Modern Philology,* Vol. 32, No. 3 (Feb. 1935): 233-60.

[244] "Parole forestiere, son quelle che noi togliamo in prestito da Nationi di linguaggio diuerso. Talche una voce altroue Cittadina, & propria; a noi sarà forestiera, & Figurata: & un Barbarismo . . . gentilmente inscritto, diuien'Eleganza" (Tesauro 157).

metonymic words for the telescope, as the core unit of a telescope itself.[245] The telescope, an instrument, becomes a medium to make knowledge possible to spread knowledge through scientific discoveries and scientific readings. Scientific instruments were important in Galileo's practice. While the telescope became more famous than other instruments at that time, Galileo had also built a military and geometric compass, and had written a short manual to explain its use.[246] Properties detected in the study of nature depend on the use of instruments in observations, so that scientific instruments only exist in relation to scientists using them. There is no scientific agency in scientific objects, in the way Bruno Latour would recognize in twentieth-century scientific discoveries as processes.[247] Distinctions among objective and subjective qualities might sound suspicious and tending towards atomism, according to Pietro Redondi in *Galileo eretico* (1983) who argued that Galileo's theories and methods, if radically interpreted, might suggest that properties such as color, coldness, and properties in matter depend on the observer detecting those traits. If such was the case, it was an attack against theological knowledge of the transubstantiation doctrine that became a dogma at the Council of Trent in 1551.[248]

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[245] The word for telescope was invented at a dinner hosted by the Medici. The word, constructing on Greek words "telos" (far) and "skopein" (to observe), would be more prestigious because it derived from Greek, sounding better than Latin "perspicillum" and Tuscan "cannocchiale." During a dinner on the Gianicolo hill, guests tried to read the frontal inscription on the Laterna church, about three miles away, by looking into a telescope. One of the dinner guests would publish the first book with instructions on the telescope one year later: Girolamo Sirtori, *Telescopium: sive Ars perficiendi novum illud Galilaei visorium instrumentum ad sydera in tres partes divisa*. Frankfurt: Paul Jacobi for Luca Jennis, 1612.

[246] Galileo had built a geometric and military compass thanks to the help of a craftsman, Antonio Mazzoleni, living at Galileo's house. The scientist donated that compass to the Duke of Mantua, Vincenzo Gonzaga, especially, and the compass is now found in the Peabody Collection of Historical Scientific Instruments at Harvard University Museums. There was also a short handbook to illustrate the use of the military compass, which causes some controversies because Baldassarre Capra had circulated a version of that manual.

[247] See Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press, 2008; Steven Connor, *The Madness of Knowledge. On Wisdom, Ignorance and Fantasies of Knowing*. London: Reaktion Books, 2019; Chapter 4, "Quisition."

[248] Pietro Redondi, *Galileo eretico*. Torino: Einaudi, 1983 (English translation, *Galileo Heretic*. Princeton: Princeton University Press, 1983.

Subjective properties do not seem to exist by themselves, in nature, but it is the mediating role of scientific instruments, thanks to scientific observers, that makes properties known and apparently objective.

More questions remain unanswered for modern readers of Galileo's poem. Was Galileo alluding to himself, as the medium of scientific communication, with hunters metaphorically being his rivals and those who condemned him at the 1633 Inquisition trial? As blindness had started to limit Galileo's work in his house arrests at Siena and Arcetri, passing from shadows to light could also refer indirectly to the physical and psychological discomfort caused by deprivation of light, and sensitivity to light for Galileo. The telescope is, for Galileo unable to use it, an object that lost its function as an instrument to track down astronomical phenomena, and its name was gone, too. In the enigmatic list of properties in the poem, the first, and last missing thing is the name, so that identity relies on the word that defines one's name.

As seen across scientific texts in prose, poems, and informal notes, imparting new information, particularly in the case of science, requires both knowledge of the topics and a language to express it, because words give the power to recall, describe, and share in communication.[249] Knowing the Book of Nature occurs in two ways: reading and having direct experience, and learning, to which one might add also writing about science. A previous leading theory was that of a chain of being, or scale of creatures, possibly helping to interpret increasing levels of complexity in the natural world.[250] Such connection across knowledge modes is possible through metaphors, as Tesauro argued in his rhetorical

[249] See Maria Luisa Altieri Biagi, *Fra lingua scientifica e lingua letteraria*. Pisa: Istituti editoriali poligrafici internazionali, 1998.
[250] *Dictionary of the History of Ideas*, ed. Philip P. Weiner, Charles Scribner's Sons, New York (1974): 325.

handbook, *Il cannocchiale aristotelico* ("The Aristotelian Spyglass" 1660), because witty metaphors achieve "brevity," "novelty," and "clarity" (Snyder 86).[251] Tesauro demonstrated that metaphors are the best achievement of a human mind for pedagogical purposes ("il più ingegnoso e acuto… parto dell'humano intelletto," Tesauro 245).

Similarly, the correspondence between one element and another, in nature, outlines human understanding and establishes a hierarchy of disciplines, and writing about nature encompasses not only science, but also painting and poetry.[252] In the continuous flow of experience, qualities and quantities seem to be meaningful criteria to understand reality, which Marino's poem *Adone* acknowledged on the basis of Aristotelian categories for science to introduce understanding with "qualities and quantities shown in each being" ("qualità, quantità mostra in ogni ente"; *Adone* X, 131, 2), through the mediating role of Reason "weighing items" ("pesar le cose"; 132, 6).[253] What is, instead, unique, shows in the personification of Wisdom, "Sofia" by her Greek name, which looks like a "primal

[251] Jon R. Snyder, "Art and Truth in Baroque Italy, or the Case of Emanuele Tesauro's *Il cannocchiale aristotelico*," *MLN* 131.1 (2016): 74-96. "L'altra simiglianza è fra due cose soggiacenti a due generi diversi, et dipendenti da un sommo genere analogo. Et questa loicamente chiamo io simiglianza analoga, di proportione" (Tesauro 259-60).

[252] Writers need to mediate knowledge and make it accessible to their readership, given that "a human intellect cannot rise to the sky, / nor can human writing leap into the heavens" ("Intelletto terreno al ciel non sale, / né fa volo divino penna mortale"; *Adone* III, 59, 7-8). The editor of Galileo's national edition, Antonio Favaro, understood the potential of incorporating sketches and diagrams in the national edition of Galileo as counterparts to his scientific works ("Le numerose figure che illustrano i *Dialoghi*, le abbiamo riprodotte in facsimile da quelle dell'edizione originale, perché alcune di esse non sono puramente geometriche, ma hanno altresì qualche cosa di artistico, che ci piacque conservare; tanto più che si può anche congetturare che siano state disegnate dallo stesso Galileo, il quale, come è noto, era valentissimo in quell'arte"; *OG* VIII, 24). Favaro's editorial statement clearly is founded on Galileo's authorial reflections ("[…] in pericolo di scapitare qualche poco nell'opinione del lettore, col dire che dall'incontrarsi tanto esattamente i miei disegni con i suoi, e massime quei della seconda macchia, si accertava del mancamento di paralasse [sic], ed in consequenza della loro gran lontananza da noi; perché con gran ragione potrà esser messo dubbio sopra tal sua conclusione, poi che le figure ch'io mandai furon di macchie disegnate solitarie e senza rispondenza ad alcun'altra o alla situazion nel Sole, il cui cerchio né anche fu da me disegnato; il che mi lascia altresì alquanto confuso, onde egli abbia potuto accorgersi dell'averle io precisamente, o no, compartite e disposte"; *OG* V, 218-19).

[253] The words for quality and quantity in Italian are invariable in the singular and plural. Consequently, I interpret the text translating the plural for "qualities" and "quantities" respectively.

mother of everything else" (*Adone* X, 130, 1-8; "madre universa! de l'altre tutte", 4): Wisdom is sunken, pale and tired, with shabby hair, walking barefoot and wearing rags; still, she is on the stalls of what is knowledgeable. In addition to theoretical claims on the structure of nature as a book, I will examine practical applications of such knowledge of nature in quantitative disciplines, applied technologies, and practical circumstances in the following chapter.[254]

[254] See *Adone* III, 121; III, 160, 7-8. "A vermilion poppy / is used to bend its sleepy head" ("papavero vermiglio / piegar la testa sonnacchiosa suole," V, 148, 2-3). In this passage, a marking in things is visible not in the flower, but in its behavior, thus confirming a case of "signatura rerum" in Renaissance terminology. The flower looks sleepy, if we look at the ways its head bows, because poppies induce sleep and stupor, as the ingredient for opium. On secrets, see William Eamon, *Science and the Seecrets of Nature: Books of Secrets in Medieval and Early Modern Culture*. Princeton: Princeton University Press, 1994.

Chapter Three. "Data Persuasion: Quantification and Authority in Scientific Writing."

1. From Natural Observations to Scientific Data.

One important component of scientific observations is the collection of data to measure, assess, and interpret. By measuring items, one determines their numbers and importance. Whether we list items for scientific measurements, daily routine, or check for a specific quantity or weight of items, knowing numbers is fundamental. Numbers indeed belong to the Book of Nature metaphor, and as such they are such a presence taken for granted. Thus, I intend to explore how numbers became important in scientific narratives, concentrating not on when people started to write down numbers, as that pertains to the history of mathematics and applied disciplines, but on the reasons to include numbers in texts. Clagett and Saiber, among others, examined the history of mathematics to find answers on specific cultural and scientific aspects of historic innovations such as standardizations and mathematical notations. From my analysis in the previous two chapters, I have introduced concepts such as scientific communication, persuasive writing, and scientific novelties, but also prestige and authority deriving from the knowledge of qualitative facts. Describing certain qualities needed quantification and measuring to occur, so that numbers could be expressed through words through a method both philosophical and geometrical.[255]

This chapter explores contexts and motivations regarding numbers in writing, and the historical moments when that strategy became the relevant proof and evidence of solid, authentic scientific knowledge. From the original Book of Nature metaphor in which the language of

[255] "Ma acciocché quello che nel fine di questo discorso è stato da me con metodo demostrativo e geometrico scritto, possa essere inteso ancora da quelli che non hanno mai applicato il pensiero a' studii di geometria, mi sono sforzato esplicar il mio concetto con uno essempio e con la considerazione delle cose stesse naturali, per il medesimo ordine appunto con il quale io cominciai a dubitare intorno a questa materia."

mathematics was fundamental, I have now shifted to the study of applied mathematics, and the narrative forms that made those stories possible. One of the early supporters of numeric importance, Father Castelli, a student of Galileo, believed in the power of mathematical calculations to predict and anticipate what could happen in nature, and consequently prepare technological applications in hydraulics and engineering.[256] Another friend and supporter of Galileo, Giovanni Ciampoli, believed that both science and the divine interpretation of nature are valuable elements for curious, inquisitive readers.[257] He also maintained that nature has so many fields of study, that we have not a book, but a library to gain knowledge ("libraria di tanti volumi che mai finirà di studiarsi"). Accordingly, having specific knowledge in mathematics and applied sciences increased prestige, authority, and the power that knowledge bestows on people. Since the Book of Nature metaphor originated a variety of experiences in scientific knowledge, both qualities and quantities were included in its perspectives, all the while aiming for science to be encyclopedic in scope.

[256] The passage quoted is from *Discorso del modo di conservare i grani* ("ancorché io abbia sempre fatto maggiore stima delle conclusioni guadagnate con saldi e ben fondati discorsi che di quelle che l'esperienza ci rende manifeste."). Castelli also wrote technical treatises on hydraulics (*Della misura dell'acque correnti*; *Considerazioni sopra la bonifica della palude pontina*).

[257] "[…] due sono le Bibbie, nelle quali Iddio è maestro" (Giovanni Ciampoli, *Prose* 118).

2. Applied Sciences.

Quantification became a relevant rhetorical strategy when Santorio and Galileo introduced numbers, measurements, and time into their works, describing numbers even before thinking trends inspired by Bacon influenced British and European intellectuals. Connections between science and humanism were complex, especially before notational conventions were introduced at the end of the sixteenth century. For a long time, mathematics was expressed in verbal language, not in symbols and equations as it is today. Another descriptive mode of mathematics was used in time-keeping, for which some of the earliest records are found in historical texts. History is, after all, in part the task of keeping track of years and how events progressively impact human history.[258] The reform of the calendar correlated numbers and astronomical motions to make sense of seasons and to determine the date of religious holidays. In optics, too, keeping track of time relied on an intuition of numbers, as Castelli showed through a pedagogical example of the illusory vision we have when we stare at a window for a certain time, to be precise, the length of reciting a psalm.[259]

The natural world also needed measurements, when applied mathematics was used in hydraulics, optics, and engineering. It was, again, Castelli who wrote that it is difficult to measure things that are closer to us, whereas we achieve great precision achieved in astronomical observations.[260] That insight had also been expressed in poetry, as when Marino commented on the experience of reality through our senses: "to enable first the senses, and then the mind, to graps what one understands and feels" ("per far di quanto intende e quanto sente / prima il senso capace

[258] "[…] nello spazio di quasi settanta secoli, nei quali si ristringe tutta la notizia delle memorie umane, la diligenza di tutte le genti n'ha letto con osservazioni innumerabili una minima particella." For a discussion of human history in scientific disciplines, see Ezio Raimondi, *Un teatro delle idee*.

[259] "[…] tenessero fermo l'occhio tanto spazio di tempo che uno dicesse v.g. il salmo *Miserere*" (*Discorso sopra alcuni particolari del modo di farsi la vista*).

[260] "[…] queste notizie, ancorché di cose prossime a' nostri sensi, son talvolta piu' abstruse e recondite che le cognizioni delle lontane, e molto meglio e con maggiore esquisitezza di conoscono i movimenti de' pianeti e periodi delle stele che quelli de' fiumi e de' mari" (*Della misura dell'acque correnti*, 1660). In the quoted passage, Castelli was referring to Galileo's observations and prospective calculations on sunspots.

e poi la mente" *Adone* VI, 16, 7-8). In order to show the type of persuasion that data can achieve among readers of scientific texts, I will discuss why quantity counts, and what values one can find in referring to quantity in a written text that may, or may not, be technical.

To start with an example I have already discussed in the previous chapter, numbers and quantitites prevent, or conversely allow one to understand physical, medical, and astronomical topics. Through cryptography, messages can be concealed or revealed to parties that were meant to lack, or have such scientific knowledge. Additionally, units of measurement keep track of numerical values and their contexts, so that if one does not fully grasp the value of units of measurement, and what is being measured, there is no knowledge transmissed to the reader. Is knowledge elitist or, in other words, are there moral values in sharing a physical experience in its full details, numbers included?[261] Studying data, anticipating results, and learning from experience are valuable insights from science and its applications today, as we often see in rhetorical strategies for news broadcasting.

Numbers are carriers of meaning and their presence innovates scientific, or any writing. Whether it is Galileo estimating the size of Dante's afterworld, as Antonio Manetti and Alessandro Vellutello did before him, or a routine measurement that is mentioned in writing to prove a factual precision, numbers help writers to construct a rhetorical argument connected to both textual and natural observations[262]. In stylistic conventions of the scientific genre, there is no real bias against the use of numbers, though no one has introduced numbers and measurings massively as Galileo did in his books. On the other hand, there had been studies on numbers in literature, broadly speaking, because poems relied on numbers to regulate the rhythm of the words and verses. Such

[261] Emanuele Lugli, *The Making of Measure and the Promise of Sameness*. Chicago: University of Chicago Press, 2020.
[262] For a discussion of Manetti and Vellutello, see Stefano Baldassarri and Fabrizio Lelli, eds. *Umanesimo e cultura ebraica nel Rinascimento italiano*. Firenze: Angelo Pontecorboli editore, 2016.

rules were found in a theoretical treatise that became the standard handbook of Baroque writing, *Il cannocchiale aristotelico* (*The Aristotelian Spyglass*) by Emanuele Tesauro, where the author argued that numbers are important for prose and poetry because a certain combination of sounds makes a good rhythm and helps memory, as I showed in each component of scientific writing and metaphors in this research. As he wrote, "one can feel the concept stamped in the mind, and their number [rhythm] echo in one's memory" ("tu te ne senti imprimere il concetto nella mente, et risonare il numero nella memoria").[263] Furthermore, numbers can add a layer of meaning and make enigmas sound witty, so one of them explains that "the number of fingers among which the Sun shines means a decade: in showing a hand three times, it means three decades" (Tesauro 43; translation mine).

Through scientific instruments, assessing orders of magnitude became possible with the military compass, the thermoscope, and the telescope. Scientific instruments were described in scientific writing and literature as confirming tools and evidence of correct reasoning, recording. In the next chapter, examples from medicine and pharmaceutics will confirm the prestige and persuasion in the public, ranging from the promotion of new therapeutic remedies locally and nationally, for example when an herbal remedy, guaiac, was imported to treat syphilis starting in the early sixteenth century. Along with his scientific books, Galileo was also marketing scientific instruments that he had invented and developed. In several marketing campaigns, Galileo had tried to sell the telescope and to patent a method to calculate longitude to the Gonzaga ruling family in Mantua, but also King Leopold of Poland, the royal family in Bavaria, and the royals in Madrid. The campaign to promote the telescope was both theoretical and practical, with Galileo explaining

[263] "[…] you can feel the concept stamped in your mind, and you hear that resonate in your memory" (Tesauro, *Il cannocchiale aristotelico* 114).

what the telescope allowed one to observe, and through public demonstrations of the telescope through his friends, for example Esau del Borgo visiting the Spanish court.

Interdisciplinary interests emerged from physics and mathematics, to botany and medicine, an integration of the disciplines and methods seemed to be encouraged because the method for all sciences was the same. Giuseppe Moleti (1531-1588), a professor at Padua University, signed his works as mathematician and physician ("mathematicus et medicus"). The knowledge of mathematics and medicine was an integration that perfected a unity already present in nature, as the Book of Nature metaphor proved. Physician and mathematician Girolamo Cardano referred to such properties in nature as fundamental to the human understanding of the world and of human health through the understanding of "sympatheia," a correspondence within natural elements regulated by analogies and opposites and a mathematical state of balance.

In addition to the textual cases so far discussed, useful pedagogical tools were scientific diagrams, condensing both qualities and quantities in visual forms. One innovative scientific diagram was printed in a catalogue of plants at the botanical garden of Padua, the first research institution and practical laboratory of that kind. The garden had been founded in 1545, thanks to the support of the Republic of Venice, thus fulfilling the request of medical professors asking for a practical laboratory to train medical students, so that they could learn to recognize plants and make compound medications. A problem soon arose, though, because many plants and herbs were stolen overnight, when the garden still did not have walls or locks for a long time. Therefore, a publication was planned, and the director of the garden, Giacomo Antonio Cortuso, wrote *L'horto de i semplici di Padova* (Venice: Girolamo Porro, 1592) with the goal of listing plants, counting them, and keeping track of where all herbal medications were found. Such guidelines made it very appealing for a textbook printed for educational purposes, so that blank pages with numbers and

lines, for each garden bed, were a good way for students to annotate their own copies, to check what they could recognize in their mandatory practicum taking place in the outdoor lab in May when the season was best.

An overall map of the garden was first presented, to "see, measure, and show a drawing of the entire groundplan of the garden" ("vedere, misurare, et torre in disegno tutta la pianta del giardino," from the Preface), which makes it look like a microcosm, and its representation resembles a mappamundi. Then, there were maps for each section of it. The book illustrations were, in fact, a new form of scientific diagram capturing both a descriptive and artistic value, as well as numbers showing how many plants were in each.[264] At the end of the volume, there was also a list of all plants, in alphabetical order ("indice di tutte le piante").

[264] "È da sapere che i numeri, che si veggono nella pianta di ciascun'ara del giardino, significano le arelle particolari, e distinte, ove sono situati i semplici . . . si potrà scrivere il nome nell'indice di quell'ara al numero corrispondente alla detta arella."

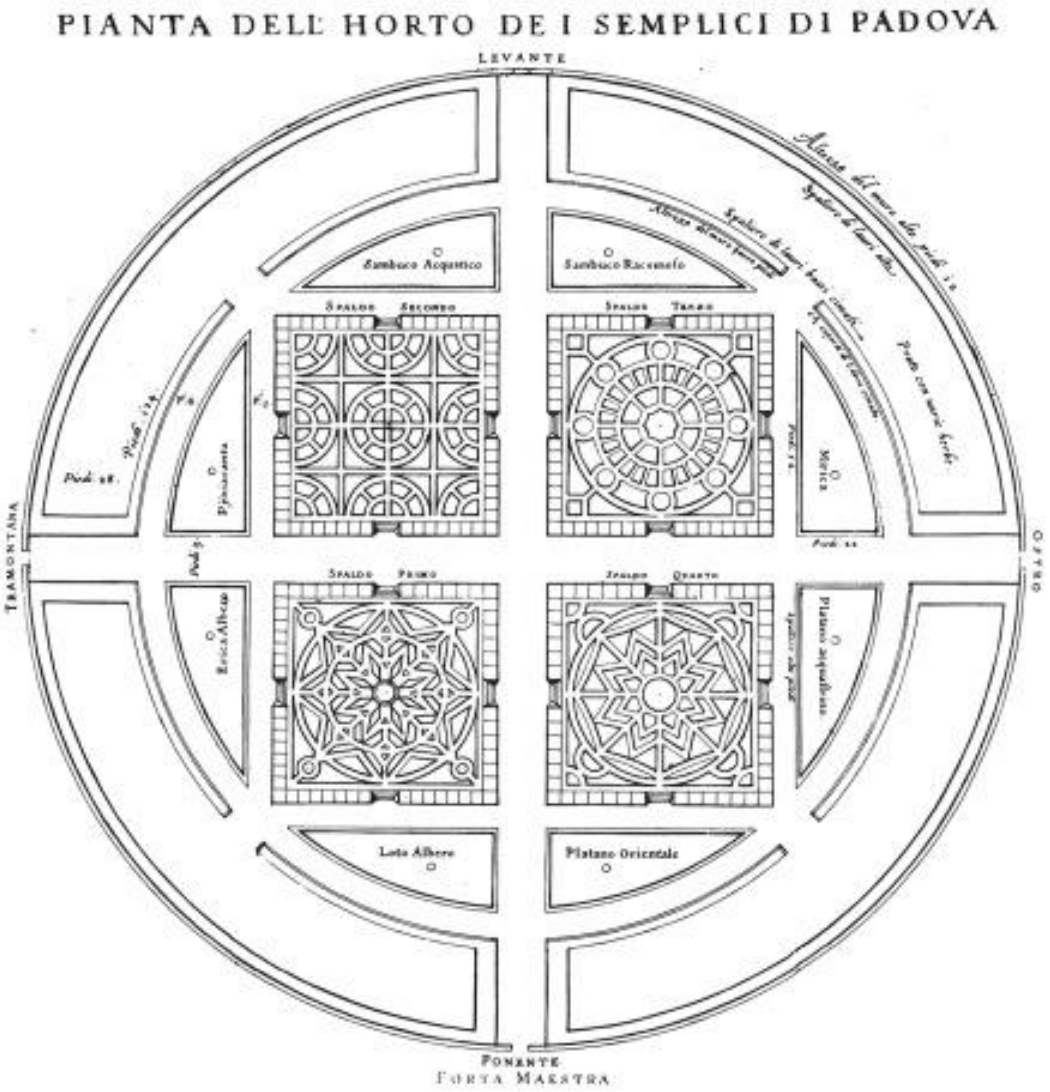

Figure 6. A map of the Botanical Garden in Padua, ca. 1592.
Giacomo Antonio Cortuso, *L'horto de i semplici di Padova.* Venice: Girolamo Porro, 1592.

3. In Praise of Science: Unconventional Women.

In this chapter, I will discuss the role of writers that have been overlooked in studies of early modern science. Women scientists were never numerous, but I may cite publications of women writing in prose such as Camilla Erculiani, Caterina Sforza, Suor Maria Celeste, Elena Lucrezia Piscopia Corner, or in poetry, such as Margherita Sarrocchi. Given the scarcity of sources available, for the timeline considered in this study, and in the geographical area of Italy, my discussion is relatively brief and concise in terms of scientific genre conventions and innovations. For example, one of those authors, Camilla Erculiani, was a pharmacist, a rare privilege accorded to women in the Republic of Venice, as I ascertained from archival sources at Padua, Venice, and the Law Library of Congress. Her training and expertise showed also in the title of her book, as an apothecary ("speciala").[265] In *Lettere di philosophia naturale di Camilla Herculiana speciala alle tre stelle in Padova* (Krakow: Lazaro, 1584), the author discussed a variety of topics, among which the causes of the Biblical deluge, human personalities, and the origin of rainbows. The book was printed in Poland and dedicated to the queen of Poland, who was a patron of sciences, and such editorial decisions were unusual for a non-professional writer living in the Republic in Venice. If any secrecy was needed, one cannot exclude caution and fear of condemnation from the Church. As a matter of fact, some of her theories on nature and science were unorthodox, and she was consequently put on trial by the Roman Inquisition on charges of suspected heresy.[266]

[265] She was a 'speciala' at the Tre stelle pharmacy in Padua. Though the business name changed, there has been a pharmacy in that store, in Padua, since the Renaissance. Her name was written in several variants across archival documents, including her maiden and married names, and different spellings for those: Camilla Erculiana or Herculiana, Camilla Erculiani, Camilla Erculiani Greghetti, Gregetta, or Ercoliani Gregetta (c.1540-1590?). See Eleonora Carinci, "Una 'speziala' padovana: *Lettere di philosophia naturale* di Camilla Erculiani (1584)." *Italian Studies*, Volume 68 Issue 2 (July 2013), pp. 202-229.

[266] After extensive searches in Padua and Venice, to my knowledge, no documents of the Inquisition trial are extant. See Meredith K. Ray, *Daughters of Alchemy: Women and Scientific Culture in Early Modern Italy*. Cambridge: Harvard University Press, 2015: 115; 231.

Erculiani believed in the intellectual abilities of women and proudly declared that the aim of her work was to "show the world that we are competent in all the sciences, just like men." In an introductory section, Erculiani addressed her readers ("A lettori," unnumbered), mentioning topics such as the perceived gendered compartmentalization of knowledge ("cose che non s'appartengono, secondo l'uso de' nostri tempi, a donna" and "il buon animo delle donne de nostri tempi"), but also appealing to wonder and criticizing social and gendered habits hindering knowledge access for women.[267] Furthermore, the desire of learning seemed to depend, traditionally, on a blank slate condition ("tamquam tabula rasa") that Aristotle stated, but Camilla denied on the basis that women have expertise in several fields of everyday life.

Editorial circumstances also conditioned Erculiani's choice of epistolary form, since she wanted to recreate the cultural environment for a discussion that could never be in person, because she was a woman and her physical consituttion not too strong.[268] In her first letter to Giorgio Garnero, Erculiani discussed the possible causes for the Biblical deluge. She argued that the increased human population, and human size and expected lifespan had caused the deluge.[269] From

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[267] "[…] è vero che si potranno molto maravigliar, ch'io senza veder libri, m'habbia posta a dar fuori queste quattro mal composte righe, principiando a mezzo del soggetto … ne il far questo mi da noia ancor ch'io habbia il travaglio d'allevar figliuoli, il peso del governo della casa, e l'obedienza del marito, e la mia complessione non troppo sana, quanto mi da noia il conoscere che da molti velati da spirito maligno saranno queste mie fatiche, o scritti biasimate, e tanto piu saranno tenute vane e di poca stima, per esser tenute tali le donne de nostri tempi . . . la volonta mia, insieme con il desiderio de miei pensieri."
For other texts by women, in which the authors advocate for equal wits and desire to learn for women, see Moderata Fonte, *Il merito delle donne*. Venice: Domenico Imberti, 1600; Lucrezia Marinella, *La nobiltà et l'eccellenza delle donne, co' diffetti et mancamenti de gli huomini*. Venice: Giovanni Battista Combi, 1621, and Elena Lucrezia Piscopia Corner, *Helenae Lucretiae Corneliae Piscopiae opera quae quidem haberi potuerunt.* Parma: Ippolito Rosati, 1688. On 25 June 1678, Elena Lucrezia Cornaro Piscopia, a Venetian woman of noble descent, received her Doctorate in Philosophy at the University of Padua. It was the first university degree conferred to a woman.

[268] "Ne potendo io a questa sua dimanda dargli altra sodisfattione di parole, gli l'ho voluto dare con il scrivergli, poiche [sic] non posso parlare con quella in voce, per esser molestata d'una terzana gia [sic] tre mesi" (9 April 1581, signed "Camilla Herculiana Gregetta"). Those lines end the collected letters by Erculiani, published in 1584

[269] On the Biblical deluge, Erculiani wrote as follows: "il diluvio . . . venne per esser cresciuti gl'huomini tanto sopra la terra, in numero, e grandezza di corpo, e longhezza di vivere, ch'havea appresso il peccato molto sminuito l'elemento della terra." She also showed some knowledge of astronomy, as she investigated the best locations to observe the sky at night ("in che luogo si ponno meglio specular le cose celesti e de la natura . . . non gl'e impedimento alcuno che vi tolga il vedere il corso celeste, e in fatto ne mena a vedere tutte le cose, e come stia questa macchina mondana").

numerical considerations, she intended to move to astronomical studies and, thus, presented many traits in human personalities as ruled by planets, though her planetary system was not geocentric. In his cool response, Garnero described the motion of the Sun and the structure of human bodies, with support from other dangerous theories, namely atomism and corpuscularism. Camilla, then, defended her views on the deluge and discussed the origin of rainbows in another letter that year, where she mentioned perspectives and numbers to show her familiarity with scientific phenomena. In the last letter published in her book, Erculiani addressed a Polish knight, Martin of Berzewicz, to discuss the deluge and its causes, once more confirming her independent thinking that possibly compensates for limited time to study and access books, unlike what a man could achieve as a scholar.[270] Her references ranged from the book of Genesis, Alessandro Piccolomini's book on cosmology and natural philosophy, Ovid, and the general authority of theologians and doctors of the Church.[271]

One of Galileo's correspondents was Margherita Sarrocchi who was out of eleven women corresponding with him on topics of culture and science, and the only poet to correspond with Galileo.[272] She wrote *La Scanderbeide, poema eroico* (Roma: Lepido Facii, 1606), in which she also insisted on culture and reading as fundamental values for all people. Another woman who wrote about science and pharmaceutical remedies was one of Galileo's daughters, Maria Celeste, who will be mentioned in the next chapter.[273]

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[270] "rispondo, e gli dico non haver appresso autore alcuvo [sic] letto, ne credo che sia cosa lodevole il scrivere l'opinione d'altri autori come sua propria; non ego ch'io non legga diversi autori speculando le diffinitioni loro, in quanto può passare il senso nostro, dove maravigliata de gl'ingegni e varie opinioni loro, mi sono posta anch'io a scrivere il parer mio"

[271] "E ben vero che dalli sacri Dottori, e da i divini Theologi, sono tenute altre cause, e maggioni [sic]; ma a me basta ch'Iddio e la istessa natura, non opera contra quelle, ma si serve di quella nelle opere sue." On Piccolomini, see Andrea Baldi, *Tradizione e parodia in Alessandro Piccolomini*. Lucca: M. Pacini Fazzi, 2015.

[272] See Meredith K. Ray, *Margherita Sarrocchi's Letters to Galileo*.

[273] See the fictional reconstruction of Maria Celeste's life in Dava Sobel, *Galileo's Daughter*.

4. Galileo's Handwritten Notes.

The official perception of what an early modern mathematician looks like is possibly captured in a painting attributed to Jacopo de' Barbari (ca. 1495, Museo Nazionale di Capodimonte, Naples). The artwork shows two men standing next to a table full of mathematical tools. One of them is Fra Luca Pacioli, and in the margin of the painting we also see an open book with geometric figures, Euclid's *Elements*. In the painting, Friar Luca Pacioli impersonates commonalities between mathematics and the humanities, but the solemn portrait has other key elements to consider, such as social status, a book of reference on which the friar's hand rests, and a small blackboard with visual diagrams that he shows with his right hand.[274] This type of mathematical work certainly existed, and might have resonated with much of Galileo's practice in arithmetic and geometry as scientific disciplines applied to pedagogical practice.

Figure 7. Jacopo de' Barbari, *Portrait of Fra Luca Pacioli and an Unknown Young Man* (1495). Napoli, Museo Nazionale di Capodimonte

[274] See Arielle Saiber, *Measured Words: Computation and Writing in Renaissance Italy*, Toronto: Toronto University Press, 2017, on Pacioli and this painting.

There was, however, a more private dimension of mathematics for Galileo, as seen in Galileo's records. Galileo was not only a scientist, a humanist, and a writer, but also an observer of everyday life that he recorded in expense logbooks and, at times, in quick memos on the back of envelopes and on fugitive pieces of paper. The source for the majority of informal uses of numbers is a logbook of Galileo's finances for Galileo's lifetime (*OG* XIX). In the nineteenth volume of the national edition curated by Antonio Favaro, the section titled "Ricordi autografi" ("Autograph memories") shows a record of money that Galileo spent or cashed for making scientific and musical instruments, shopping lists, expenses related to lodging and income from tutoring European students, but also his university paychecks, tax returns, academic memberships, printing permissions for his books, and the 1633 Inquisition trial files.[275] Among those documents, there are also records for family expenses for Galileo's children and brothers-in-law, as well as baptism and death certificates of family members, and lists of groceries. Thanks to those archival materials and shopping lists, one can imagine what Galileo's diet was like. He would not miss meat, fish, fruit, and wine.[276] A micro-historical approach to Galileo's works can prove to be an effective method for my investigation of "what… predecessors passed over silence, discarded, or simply ignored," following the methodological approach proposed by Carlo Ginzburg (*The Cheese and The Worms: The Cosmos of a Sixteenth-Century Miller*, Preface).[277] This casual use of

[275] On Galileo's concept of music and scientific instruments as applications of mathematics, see Rebecca Cypess, *Curious and Modern Inventions: Instrumental Music as Discovery in Galileo's Italy*. Chicago; London: The University of Chicago Press, 2016.
On Galileo, mathematics, and music as numeric harmony, see my study "Sul filo della musica: armonia e scienza da Mersenne a Galileo." Essay review of Natacha Fabbri, *De l'utilité de l'harmonie (*2008). *Galilaeana,* X (2013): 237-44.
[276] *OG* XIX 131-ff.
[277] Through the Inquisition trial documents regarding Menocchio's trial, the miller Menocchio became a character in Ginzburg's narrative, but he is considered "a dispersed fragment" in archival institutions of that time (Ginzburg's Preface xxvi). The quotation is from Ginzburg, Preface xiii. The 1976 book *Il formaggio e i vermi. Il cosmo di un mugnaio del '500* (*The Cheese and the Worms. The Cosmos of a Sixteenth-Century Miller*, 1980) by Carlo Ginzburg allowed the historian to bring to the foreground topics that had been, until then, relegated into anecdotal, scattered lore. That foundational work in Italian microhistory has provided theoretical support to the present study as well.

numbers and mathematics integrates my research on more formal aspects of that discipline that was fundamental to the construction of the Book of Nature metaphor. Mathematics was the language to decipher nature, and in natural and manufactured goods mathematics provided also the methods to keep track of the household economy, deeply reflecting the Greek etymology of that word as the 'management of a household.'

Galileo's extant letters are not all he ever wrote in private notes, and scholars should not easily dismiss humorous anecdotes of one scholar rescuing Galileo's letters and documents after buying some mortadella from a street vendor in Florence, to be reminded of how much was lost in transmission.[278] From extant notes, it is clear that Galileo wrote down even minute aspects of his life, thoughts, and routine, the purpose of which recording was to document personal history and to contribute to publicizing his scientific endeavors while keeping track of who was contacted, and how that communication happened. Writing was both an ambition and a dream, as Galileo revealed to the Medici secretary, Belisario Vinta, a few weeks after publishing his groundbreaking work, *Sidereus Nuncius*: "i frutti delle fatiche di tutti i miei studii passati" ("the fruit of all my past studies"). Galileo wished to earn his living by writing for the Medici family, and he metaphorically referred to his income as his bread ("il pane").[279] My microhistorical perspective, here, is a necessary tool in order to look closely at what characterizes the general picture of Galileo the

[278] What prompted Ginzburg's interest in the cosmogony was a fortuitous archival encounter during his research at the parish archives in Udine. Domenico Scandella, called Menocchio, a miller, was burnt by the Inquisition upon an accusation of heresy in 1599. Fifteen years earlier, he had been prosecuted by the Inquisition regarding some of his theological views. In fact, Menocchio's explanation of the origin was described as a process of "cheese and worms." Out of eternal chaos, there appeared angels as worms do from decaying cheese. Controversies regarding religious and astronomical matters was a problem for Galileo too, which induced him to recant his scientific theories in 1633, and afterwards he was in house arrest at Arcetri until he died in 1642.

[279] I am referring to Galileo's letter to Belisario Vinta written on 7 May 1610 (*OG* X 350): "sono in tutti i modi resoluto, vedendo che ogni giorno passa un giorno, di mettere il chiodo allo stato futuro della vita che mi avanza, et attendere con ogni mio potere a condurre a fine i frutti delle fatiche di tutti i miei studii passati, da i quali posso sperarne qualche gloria . . . Et in somma vorrei che i libri miei, indrizzati sempre al Ser.mo nome del mio Signore, fussero quelli che mi guadagnassero il pane."

scholar – still, an important part, which has not received sufficient scholarly attention yet.[280] "Ogni giorno passa un giorno" ("Every day, a day goes by"), Galileo commented in a passage sounding like a Stoic aphorism.[281] The reconstruction of Galileo's private life, showing daily routine thanks to microhistory, will reveal a new facet of the scientist's life and work on a daily routine.

Galileo's notes on food and everyday life expose an unusual Galileo, an individual who belongs to the larger community of the early modern time in Pisa, Padua, Florence, and Arcetri.[282] The majority of Galileo's scientific discoveries occurred during his time as a mathematics professor at the university of Padua. It was also the best time of his life, as he recalled writing from Arcetri to his friend Fortunio Liceti on June 23, 1640 (*OG* XVIII, 207-09). In Padua, where he taught mathematics, Galileo lived with Marina Gamba and their three children: Virginia, later Suor Maria Celeste; Livia, later Suor Arcangela, and Vincenzio. Their house not far from the Basilica of Saint Anthony, neighboring the house of Gian Vincenzo Pinelli, his friend and patron, who (as noted above) had a magnificent library.[283] Galileo's family also hosted tenants, who were all Galileo's students, and a servant. Twenty-two servants worked for Galileo in eighteen years between 1602 and 1620, with a quick turnover in hiring help at home. A big kitchen was necessary for all people living there, with a chicken-coop, a sideboard ('credenza') and a table in poor shape, a kitchen chest, forty tin plates, a dish warmer, two copper basins, two copper baking pans, a

[280] Giorgio Strano's essay is, to the best of my knowledge, the only scholarly work on Galileo's shopping habits. In his essay, "La lista della spesa di Galileo," he examined the expenses related to experiments and the production of scientific instruments.
[281] Letter to Belisario Vinta (May 7, 1610; *OG* X 350).
[282] Born and raised in Padua, I became fascinated with the locales and culture where Galileo spent "the eighteen happiest years" of his life, as he wrote from his house arrests in Arcetri, near Florence, in a letter addressed to Fortunio Liceti living in Padua (June 3, 1640 *OG* XVIII, 207-09): Non senza invidia sento il suo ritorno a Padova, dove consumai li diciotto anni migliori di tutta la mia età. Goda di cotesta libertà e delle tante amicizie che ha contratto costì e nell'alma città di Venezia."
[283] Pinelli was among the early supporters and friends whom Galileo had after moving to Padua in 1592. Pinelli's earliest letters to Galileo, in fact, date back to September 1592, when Galileo started his lectureship at the university (*OG* X, 47-50).

copper tray, three copper cauldrons, a pan and grill, a stone mortar, two big iron knives, and two smaller ones.[284] In Galileo's notes, there is also a list of good quality silverware ("argenteria") and only one refined collectible candy box ("una confettiera d'argento," *OG* XIX 158). Knowing what was available at home also served the practical purpose of quantifying metal available for recycling to produce scientific instruments, as happened for old spoons ("cucchiari vecchi libre 3 ½").[285]

Dietary habits are also revealed in Galileo's handwritten notes. As Roland Barthes maintained in his foundational text on food and culture studies, food is "a system of communication, a body of images, a protocol of usages, situations, and behavior."[286] Galileo's shopping lists were tied to two variables: food availability and, consequently, price. In particular, food price depended on seasonal production, quality, and inflation, a process that Galileo tried to explain by examining inflation and fraud (*Scritture concernenti il quesito in proposito della stima d'un cavallo,* in *OG,* VI, 591). Unfair prices resulted from a mistaken evaluation of goods, both on the seller's and on the customer's side, as was the case for overpriced saffron and lemons (*OG* VI 596). When an item was not available, sellers might find a replacement, as Alessandro Ninci did when he sold cheese ("raviggiuoli"). Cheese was gone before he could send it to Galileo, and he blamed his servant or a cat smarter than his servant. As a result, Ninci shipped another type of cheese, to which he added complimentary apples to compensate for replacing one type of cheese with the one he had available ("quattro forme di cacio… e cotogne n.o 33").[287] Furthermore, fewer

[284] The original passage reads as follows: "[…] in cucina: una stia … una credenzaccia… una tavolaccia… una madia vecchia, piatti di stagno, tra piccoli e grandi, 40 pezzi, uno scaldavivande d'ottone, due catinelle di rame, una teglia di rame, una ghiotta di rame, un rinfrescatoio di rame, paioli tre, padella e graticola, mortaio di pietra, due coltelli di ferro grandi e dua piccolo" (*OG* XIX, 564). A final note regarding Galileo's eating habits is the record for food provisions ("grasce") which had been left at the moment of Galileo's death.

[285] From a note which Galileo scribbled, we read about recycling intentions ("Trattare in materia di scodelle di ferro, o di gettarle in pietre, o vero come le palle d'artiglieria"; *OG* XIX, 132).

[286] See Barthes 167. Barthes' publication is mentioned on the Food and Agriculture Organization of the United Nations website (http://agris.fao.org/agris-search/search.do?recordID=US7946397).

[287] From a letter by Alessandro Ninci (*OG* XVII, 197; 12 October 1637): "Prego V.S. a scusarmi se non resta servita conforme al suo desiderio, perchè in questo paese per quest'anno non si trova meglio, se bene di questa sorte ora non

items were delivered than expected, thus Galileo complained about receiving fewer beets than he had ordered from Ninci ("barbe di bietola," Favaro, *OG* XVI, 180). The record about Galileo's complaint to Ninci adds to the general feeling one gets, when browsing his expense records, that he was – and had to be, cautious about money, in a lifelong struggle for economic stability. Accordingly, Galileo would complain about the quality and quantity of food.

Since expenses were a cause of concern, Galileo was very appreciative when friends sent food and wine as a gift. Financial concerns were on his mind even when he had the pleasure of a new scientific discovery. On his own note about the discovery of Jupiter's moons, included in the book he published on 13 March 1610 in *Sidereus Nuncius* (*The Starry Messenger*), there is a sketch of the Medicean stars drawn by Galileo on the margin of a letter from Syria, sent by Sagredo, but also Galileo's own handwritten note: "boxes, money, tablet, mask" ("Scatolini. *soldi*. [sic] Tavoletta sottile. Maschera" in *OG* X, 262). Both money and food were important things to remember in Galileo's agenda. In a marginal note on Benedetto Castelli's letter, Galileo wrote down some mathematical considerations, sketched the Medicean Stars, and added a note about bran, bread, wine, and study room ("Crusca. Pane. Vino. Studiuolo"; *OG* X 183-84, dating back to 18 September 1637). Furthermore, in a marginal note, he listed the following items: fish from the Arno river, crabs, eels, pikes, mushrooms, cheese, melons, peaches, eggs, anchovies, figs, cherries, wine, bread, lemons, grapes, lentils, while also reminding himself to "find herbs to replant and find the farmer."[288]

There is a special section for it recorded in Galileo's notes: "spese per carnami" ("meat expenses"; *OG* XIX 180-81). A great portion of Galileo's recorded expenses consisted of meat.

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ne manca. Avevo provisto i raviggiuoli, ma la trascurataggine di Santi, o la troppa destreza d'un mio gatto, mi proibisce il poterli mandare; procurerò bene che V. S. n'abbia la prossima settimana."

[288] "Pesci d'Arno, granchi, anguille e lucci, Funghi, raviggiuolo, zatte. Seleni, pesche, vuova, acciughe. Fichi, azeruole, vino 3 fiaschi. pane, limoni, uva, lente. Erbe da trapiantare. Trovare il fattore" (*OG* XII, 270).

Trusted butchers from whom he shopped were in the Pontecorvo neighborhood, very close to Galileo's home in Padua, and in Abano Terme, by the Euganean Hills.[289] Galileo's friends must have known about his preference for meat and wild game, because Ascanio Piccolomini was very apologetic for not having a good hunting season to send some food to Galileo.[290] Therefore, Ascanio sent wine, instead.[291] Ascanio was reciprocating the favor, since Galileo had sent fruit a month earlier: melons, plums, and peaches.[292] Another person with whom Galileo exchanged food gifts was Alessandro Ninci who had sent wild game.[293] A year later, Galileo would send a gift to Ninci, too, and Ninci wrote back to thank for the wine and melon he received.[294] Christmas gifts, oftentimes consisting of food, were exchanged between Bernardo Conti and Galileo, as we find out from their letter dating back to December 23, 1634.[295] Galileo also favored wine and had his own vineyard, at least since 1603, when he recorded buying tools for the pergola vine training and the vineyard.[296] When he rented a villa in Bellosguardo, Florence (1617-1620), his farm produced wheat, fava beans, lentils, chickpeas, wine, and olive oil ("grano, fave, lente, ceci; vino, olio"; *OG* 183-88). One of his daughters, Maria Celeste, also took after her father's interest in farming and

[289] From the butcher at Pontecorvo, he bought "[…] lib. 16 manzo, et più, per altre lib. 8, et più, per sovranello lib. 21"; on 5 January, "agnello e castrato"; on 12 January, "agnello e porco"; on 2 February, "vitello."
[290] "[…] le caccie mi vanno male, onde non posso farle assaggiare due starne" (17 October 1636; *OG* XVI, 505).
[291] In a letter dated 14 October 1636: "[…] prima tramuta… condizionato a suo gusto"; on 17 October 1636: "[…] si è avvertito di pigliarlo di sito, come dicon qua, tischioso, m'assicuro che non farà la burla dell'altro anno" (*OG* XVI 504).
[292] Ascanio thanked Galileo for "[…] le zatte, con le simiane e con le persiche, che in questa continuatione della state non può essere regalo più desiderato" (13 September 1636; *OG* XVI, 484).
[293] Namely, "[…] tredici tordi e due gazine, che costano due lire e cinque soldi, e un paio di capponi, de' quali aviserò il prezo per la prima occasione" (31 January 1636; *OG* XVII, 23).
[294] The words he used were as follows: "mi son fatto onore del vino, che per la sua esquisita bontà persuadeva di venire da principi, e della zatta che veramente fu degna di essere presentata d'onde veniva il vino."
[295] "Con la gentilissima di V.S. del 21 s'è ricevuto la verdea, le pere, le barbe di bietola e l'arance, di che V.S. ha volsuto favorire Mons.re Ill.mo Arcivescovo, mio Signore. S. S.ria Ill.ma ha ricevuto il tutto con sommo gusto; e perchè il suo mandato l'ha trovata occupata nell'ordinationi, ha comandato a me che io glie ne renda quelle maggiori gratie che si possa, come fo con questa, e che pel medesimo suo mandato io la serva per sua parte d'un capriolo, dodici starne e quattro marzapani e quattro biricuocoli di questo paese. Aggradisca V. S. l'animo col quale se li inviano queste bagattelle, che per altro sono un niente al merito di lei (*OG* XVI, 180).
[296] Specifically, "[…] per stroppe da legare le pergola… per chiodi da legare le vigne ai muri" (*OG* XIX, 169-70).

gardening, and she looked after a vegetable garden to grow fava beans, too (as documented in a letter from 15 October 15; *OG* XV 302-03).

Scientific research was time-consuming and having servants did not make one's life easier.[297] Galileo recorded hearing about an extraordinary nutrition pill that his friend Aurelio Capra had discovered from a German friend. One small pill would keep one healthy, without food or drink, for forty days (*OG* X 106).[298] Food was oftentimes on Galileo's mind, and such preoccupation (and interest) showed in his comments on his readings, for example in his annotated copy of Ariosto's *Orlando Furioso*. Galileo commented that meat or some other food ("carne o altro cibo") could be textual variants for the third line of a passage by Ariosto: "Come il mastin che con furor s'avventa / Addosso al ladro, ad acchetarsi è presto, / *Che quello o pane o cacio* gli appresenta, / *O che* fa incanto appropriato a questo."[299]

Only few recorded purchases in Galileo's archives pertain to food that is not meat. In those cases, those items are fruit and grains, as when he recorded expenses for pistachios, pine nuts,

[297] The quick turnover of servants makes one wonder if Galileo's personality might be a cause for such a high number of servants to leave only a few months after hiring. We know Galileo complained about the supposed lavishness of their expenses, for example when some servants asked for new shoes, and for new soles just one month later. Several servants were sent away ("et la mandai via," Galileo does not refrain from commenting, in his paycheck book; *OG* XIX, 173-80).

[298] In a letter written on 22 May 1604, it reads as follows: "professa gran segreti, et in particolare afferma havere una pillola, et il modo del comporla, che non essendo maggiore di una veccia, presa per bocca mantiene uno sano et gagliardo per 40 giorni, senza che pigli altro cibo o bevanda."

[299] In Galileo's note: *o se*? Another version of Galileo's notes reads: "Se pane od altro cibo ei gli si appresenta, / O se fa incanto appropriato a questo"(*OG* XIX, 181-830. On 23 September 1604, Galileo bought "[…] dal compagno di Pasqualino beccaio libre 36 di sovranello," and six days later, "dal medesimo Mattio, sovranello libre 13;" twelve days later, he owed "[…] il beccaio d'Abano… per libre 52 di sovranello, et più, per libre 27 di vitello, a dì 24 di Dicembre, libre 52 manzo." After Christmas, the shopping routine started all over again: "[…] libre 14 sovranello, a dì 29 di Gennaio, libre 39 di manzo… 40 libre di manzo mandate il d. do, et più, per lib. 35 manzo, et più, per lib. 62 manzo, et per lib. 17 sovranello, et più per lib. 27 vitello, et più per lib. 32 manzo." Again, on 20 and 27 October "sovranello, sovranello, lib. 12" and on November 3 "pollastrelli, 3 pollastrelli;" "sovranelli lib. 5 ¼"; on 10 November, "carne et luganiga"; on 17 and 24 November; on 1 December, "[…] carne"; on 8 December, "agnello et luganiga"; on 15 December, "un agnello, castrato et lonza di porco"; on 22 December, "castrato et lonza di porco"; on 29 December, "agnello et luganiga."

capers, sugar, plums, raisins, rice, melons, and fava beans.[300] A scattered note which Galileo scribbled, on the verso of an envelope, next to the address, has a list of random items: "Scarfarotti e cappelletto per Vinc.o. La cassa delle robe di marina [sic]. Lente, ceci bianchi, risi, uva passa, farro. Zucchero, pepe, garofani, cannella, spezie, confetture."[301] Galileo regularly bought great amounts of wine.[302] He purchased red wine, white wine, sometimes including also chestnuts in his purchase.[303] Friends gave wine as a gift to Galileo, for instance Niccolò Aggiunti sent twenty bottles of his favorite wines to Galileo in Arcetri in 1634.[304] Sampling wines before buying them was a common practice, both for advertising and for giving a gift one really wanted to be appreciated most. One time, Maria Celeste was worried when one shipping of wine from San Miniato was delayed (*OG* XV 302-03). She was, then, going to pick the second best wine, so that they could at least have some wine to drink in the meanwhile.[305] It also occurred that Galileo would accept credits to be returned by strangers as wine (possibly a valuable good, one would say).[306] Not only modest people, but also the Medici prince worried about giving the best option as a gift: it was not a matter of price and quality only, but also of personal preference, and a nobleman

[300] Purchases from Antonio Incontri in 1601 and 1602 (*OG* XIX, 172; 188-89): "[…] per libre 2 di pistacchi… lib. 2 di pinocchi… lib. 2 di capperi… lib. 2 di zucchero… lib. 2 di pistacchi… lib. 2 di susine… uva passa; risi" and "[…] 3 zatte… fave, fave napoletane, 4 zatte."
[301] Giorgio Strano is interested in reconstructing Galileo's study of optics and making and purchase of lenses ("vetri todeschi spianati," Strano 205-06).
[302] References to wine abound in Galileo's notes (*OG* XVI, 186-87). See also the letter by Benedetto Scalandroni, dated 7 November 1635. The seller would take care of the transportation fees, "barili sei di vino."
[303] He paid Bartolomeo Maso, in 1600-1601, for "[…] una candiotta di vin bianco et una botte di rosso et 3 staia di castagne" (*OG* XIX, 171).
[304] *OG* X, 270. On the margin to letter 255, next to a note on "Sapone, aranci . . . Malvagia da i S.i Sagredi." Favaro belies the note to be written down during a trip to Venice (given the reference to "calle delle Aqque," sic). Giorgio Strano maintained that the note was written between the end of November and early December, 1609. Favorite alcoholic beverages were noticed: "havendo in più volte messo da parte tutti que' liquori che gli son parsi più grati al gusto" (*OG* XVI, 186-87).
[305] 15 October 1633; *OG* XV, 302-03: "[…] il vino delle Rose… mi par bonissimo."
[306] *OG* XIX, 573: a debtor will pay "[…]in due some di vino."

affiliated to the Medici court wrote about the concerns of the Medici ruler regarding Galileo's health in 1637.[307]

At the other end of the transactions regarding food and wine, there were merchants. Galileo would buy food and wine from the seller or a mediator.[308] As important as it was for a friend to show gratitude, so much more important it would be for a trader to be skilled in communicating well and advertising their items. Benedetto Scalandroni wrote a letter to Galileo in 1632.[309] His commercial tone might remind one of the story of "Cisti fornaio," a skilled baker advertising and enhancing self-appreciation at the eyes of the rich diplomat (*Decameron* VI, 2).[310] After apologizing for not sending wine samples earlier, Scalandroni remarked that Galileo would inform him promptly about which wine he preferred, knowing that the price would not be an issue, as he could not disagree with an amiable person as Galileo was. It sometimes happened that wine aged poorly, as Ascanio Piccolomini and Maria Celeste complained about this problem and Ascanio

[307] "Il Ser.mo Principe mio Signore havendo sentito il bisogno dello stomaco di V.S., e premendoli quanto a lei medesima che si conservi sana, ha volsuto ch'io gli mandi due saggi di vino, uno di Monte Pulciano e l'altro di Chianti, d'uve scelte, che di presente beve S. A." He added: "V. S. potrà provare l'uno e l'altro, et avvisarmi quale se li conferisce più, acciò gliene possa mandare, assicurandola che non haverà persona più devota in servirla di me" (in a letter written by Ludovico Incontri on 20 July 1637).

[308] Giulio Ninci from San Casciano, for instance, wrote: "Vi mando staia sei di farina per Santi di Gabriello Rosi. Non do risposta dell prezo a V.S. di quela vernaca, per che il fattore nor è anchora tornato e lo speziale non à auto risposta anchora, nè mancho i sagi: subito che gli ariveranno, gli manderò a V. S. E se gli ocore niete altro, V. S. mi avisi" (18 December 1633; *OG* XVI, 274).

[309] "[…] dovevo mandarli alcuni saggi del mio vino, il che fino adesso non ho fatto mediante molti impedimenti hauti in detto tempo . . . gli mando assaggio dua fiaschi di vino di dua botte, acciò vegga se alcuna gli piacesse, e piacendoli mi avvisi il suo bisogno. Con questo tenga conto quale sia quel fiascho che più gli gusta, *acciò la possa servire secondo il suo desiderio, e quanto prima*. Quanto poi a l'avvisarla del prezzo, come mi vien detto, gli rispondo mandi addire, per il medesimo mio mandato, di quello gli fa di bisogno piacendoli, chè [sic] gnene manderò senza cercare altro, poichè [sic] *con lei sono sicuro sarò d'accordo, ancora che non volessi*. E se pure poi havessi gusto, avanti glielo mandassi sapere il prezzo, dicoli valere su i luogo il meno è 16 la soma, levandolo in fiaschi, et in barili è 14. Ma, piacendoli, non guardi a questo, poichè [sic], come ho detto di sopra, con lei non guasterà cosa alcuna. E non mi occorrendo altro, farò fine, ringraziandola prima di tante cortesie usatemi senza alcuno merito, et insieme pregarla a comandarmi di quello poco che posso, assicurandola *con ogni forza sarò prontissimo a servirla: e con questo gli fo reverenza*." My emphasis. Letter sent on 17 May 1632; *OG* XIV, 352-53.

[310] According to Savelli, Cisti performed as an early advertising agent in the Decameron. Savelli's scholarly research explores values of bourgeoise and modern age, "una sorta di proto-pubblicità" in Giovanni Boccaccio's fictional writing (Savelli 191-92).

recommended better glass containers once he noticed problems with fermentation.[311] The transition from the discussion of wine wine to other foods will be necessary, because wine was indeed considered to be a food. Therefore, merchants often sold food and wine, as one can see from Dino Peri's business selling wine and cookies; he had heard complaints and wanted to fix problems about Greek wine and biscotti that were priced incorrectly.[312] These are but a few examples of how advertising strategies were important for sellers and mediators, so that sellers and mediators could address customers' complaints and consequently save their business. As a matter of fact, persuasion is an important goal to validate one's arguments both in business and in scholarship. Also, "example" and "sample" are etymologically related.

Wine was considered to be an important aid during illnesses. Suor Maria Celeste thought white wine helped her recovery because wine soups gave her more energies.[313] Maria Celeste also wrote about her friend Suor Luisa's illness and her recovery thanks to medications not as pleasant as wine was.[314] Maria Celeste was shy about asking for help so that Galileo could send some oil useful for stomach ointments, and some nutmeg oil, too, when her sister and fellow nun, Suor

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311 "[…] con mio grandissimo disgusto ho sentito che subito si gli rinforzò . . . Un giorno di questa settimana saranno inviate a V.S. tre some di vino, che di bontà spero che non sia per riuscire inferiore a quello dell'anno passato. Ho voluto anteceparglene l'avviso, perchè V. S. possa far mettere all'ordine il vaso; e di grazia avverta che sia buono, perchè, per i grand'asciuttori che son corsi questo anno, ogni sorte di vino porta pericolo di rinforzare" (22 November 1637; *OG* XVII 224).

312 "[…] s'io ho errato circa quel greco e cantucci, la prego a scusarmi, e correggerò adesso l'errore con l'obbedirla puntualmente . . . I cantucci fini vagliono una crazia l'uno, ma i soprafini vaglion tre crazie la coppia. Dicono di farne solamente per il Palazzo, o pure a posta per qualch'uno amico etc. Son maggiori, con più zucchero e più odore, dicono. A me veramente non mi ci par miglioranza che importi il prezzo: con tutto ciò mandai a V.S. i 40 de' soprafini, com'ella chiese" (8 February 1640; *OG* XVIII, 143-44).

313 "[…] et veramente che se, in questa scesa che ho havuta, non fossi stato il vino bianco di V. S., l'havrei fatta male, perchè [sic] sono vivuta di pappe e zuppe, quali non mi hanno nociuto per esser fatte in vino così buono" (July 1631; *OG* XIV, 296-97). Suor Celeste seemed to be a wine taster whom her father trusted in dealing with traders ("[…] interrogato da me della loro bontà"). Galileo seems to have stored wine in San Matteo, secretly or not, as we read from his daughter's request to go "[…] in persona a travasarlo a suo modo, o lasciarvelo tutto l'anno."

314 "[…] se ne sta in letto con un poca di febbre, ma i dolori sono assai mitigati, e si spera che sia per restarne libera del tutto con l'aiuto di buoni medicamenti, li quali, se non sono soavi al gusto come è il vino di costì, in simili occorrenze sono più utili e necessarii" (15 October 1633; *OG* XV, 303).

Arcangela needed those during her illness.[315] The nun knew her father had a sweet tooth. Therefore, Maria Celeste's friend, Suor Luisa, added some pastries in the basket for Galileo.[316] Maria Celeste once tried to get a recipe for Siena cakes from her father.[317] Preparation of food items and exhibition of cleanliness mattered for Maria Celeste, who commented about the table cloths, pillow cases, and blankets which she used to wrap her gifts.[318] Galileo's daughters, Celeste and Arcangela, cleaned and re-used wine bottles.[319] Based on the only source available on Suor Celeste's life, that is, the extant correspondence with her father, one gets a sense of her main personality traits being kindness, gratitude, and generosity. She would give gifts, however modest, to her father (again, food) and would share gifts she had received. In 1633, during the Inquisition trial, she shared six blocks of cheese and sent three of them to him.[320] On the other hand, one cannot help but think of an older, though immature Pinocchio, while reading some of the letters written by Galileo's son, Vincenzio, in a call for help.[321] Galileo's son, Vincenzio, and Taddeo

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[315] "Il medico, quando ultimamente la visitò, ordinò fra l'altre cose alcune untioni allo stomaco con olio da stomaco del G. D. e olio di noci moscade. Dell'uno e dell'altro mie siamo a carestia, e per ciò havrei caro che V. S. me ne provvedessi un poco" (July 1631; *OG* XIV, 286-87). Maria Celeste, to whom Galileo was very close, was celebrated by Dava Sobel's 1999 novel, *Galileo's Daughter. A Historical Memoir of Science, Faith, and Lov*e.

[316] "[…] ha aggiunto nel panierino queste paste, acciò V. S. le goda per suo amore."

[317] "Ho sempre havuto desiderio di sapere come siano fatte le torte sanese, che tanto si lodano; adesso che si avicina l'Ognisanti V. S. haverà comodità di farmele vedere, non dico gustare per non parer ghiotta" (15 October 1633; *OG* XV, 302-03).

[318] "Gli rimando la tovaglia nella quale mandò involto l'agnello; et V. S. ha di nostro una federa, che mandammo con le camice, una paniera et una coperta" (December 19, 1625 in *OG* XIII 293).

[319] "Rimando due fiaschi voti" (July 1631; *OG* XIV 286).

[320] "Subito che veddi le 6 forme di cacio, ne destinai la metà per V. S., ma non glielo scrissi, perchè desideravo di riuscire più a fatti che a parole: e veramente che è cosa esquisita, et io ne mangio un poco più del dovere" (15 October 1633; *OG* XV 302-03).

[321] "E se V.S. faceva pensiero che, stando io qua su, i miei parenti ci havessero a mantenere, *per obligo loro, di pane o altro* (sia detto con la debita reverenza) la s'ingannava d'assai; perchè [sic], mentre che essi si son cavata di casa la Sestilia e datala a me per moglie, *non son in obligo di darmi un pistacchio*, fuor che quella parte di dote che mi si deve, al tempo tra noi pattuito e non prima, e questa anco vogliono che si metta in sul Monte, secondo le nostre convenzioni, *e non si consumi altrimenti in pane e vino . . .* V.S. si duole che la nostra casa habbia a sentir *poco frutto de i miei studi e fatiche*, ma di questo io non ne ho colpa alcuna; e ben sa V.S. quanto io mi sia doluto per il passato, e si può immaginare quanto al presente mi dolga, il vedermi senza impiego et avviamento alcuno, e sa quante volte e con quanta instanza io l'habbia pregata a procacciarmelo. Piacesse pur a Dio ch'io havessi tanta fortuna che mi si porgesse *occasione di affaticarmi per guadagnarmi il pane*, chè [sic] mi parrebbe d'esser fuor d'un gran labirinto e di toccar il ciel col dito (my emphasis). Letter from Galileo's son on 7 December 1630.

Galletti, Galileo's brother-in-law, must have been demanding, based on Galileo's recorded expenses. Galileo took care of many expenses for his family and in-laws, including reminders for debt and custom fees.[322] One hopes that Maria Celeste's letter and gift, consisted in a rose, citron jam and boiled pears for fasting days, could bring some optimism into Galileo's life.[323] Based on information I reconstructed through Galileo's correspondence, it seems that Galileo cared for fasting during Lent, unlike his friend Niccolò Aggiunti.[324] An alternate source for protein was fish. Fish usually replaced meat during fasting times; thus, in 1607 Galileo bought fish on 25 October, 2 November, 8 November, 15 November, 22 November, 29 November; 6, 12, and 18 December, in the preparation for the Advent, and on 2, 10, 17 January, and 2, 7, 15 March, with Easter occurring on 27 March that year.[325] It was not always easy to get fish delivered to Padua from the lagoon of Venice. The problem was not the distance, which was rather modest, nor was it transportation. Rather, unexpected public health emergencies such as plague outbursts induced

[322] It had been necessary to buy, for Galletti "[…] un quarto di galletto et 2 vesciche di grasso… un gallo et una gallina da Polverara; una candiotta di vino; 2 paia di galline et un paio di capponi; un agnello, 2 para di capponi, 4 para di pollastre, vitello libre 16… un vitello; un capretto et una barila di aqqua [sic] della Vergine;" in 1608, "[…] cotogni, nocie, due pezze di formaggio, una cesta di uva, carne, manzo;" in 1609, "agnello, vitello, farina, vesciche di grasso, carne di vitello, candiotta et sua condotta, 6 lib. di salsiccia"; in 1610, as he bought only one type of meat for his brother-in-law, "un agnello." Regarding custom fees, I found claims that Galileo should pay for those, as well: "[…] le spese del datio non pagato di due candiotte di vino; staia 30 di farina, per una botte di vino… per far condurre la detta botte vota" in *OG* XIX 194-97).

[323] "Del cedro che V. S. m'ordinò ch'io dovessi confettare, non ne ò accomodato se non questo poco che al presente gli mando, perchè [sic] dubitavo che, per esser così appassito, non dovessi riuscir di quella perfezione ch'io havrei voluto, come veramente non è riuscito. Insieme con esso gli mando dua pere cotte per questi giorni di vigilia. Ma, per maggiormente regalarla, gli mando una rosa, la quale, come cosa straordinaria in questa stagione, dovrà da lei esser molto gradita, e tanto più, che insieme con la rosa potrà accettar le spine, che in essa rappresentano l'acerba passione di Nostro Signore; et anco le sue verdi fronde gli significheranno la speranza che (mediante questa santa passione) possiamo havere, di dover, doppo la brevità et oscurità dell'inverno della vita presente, pervenire alla chiarezza e felicità dell'eterna primavera del Cielo" (19 December 1625; *OG* XIII, 292-93).

[324] From a letter written on 6 March 1630 (*OG* XIV, 85-86). Galileo's friend wrote that he did not feel like fasting ("Io non mi sento da farla") and that it seemed to be a long time ("Circa la quaresima, posso dirgli che la lunghezza sarà al solito degl'altr'anni; la profondità, i' non la intendo; la larghezza, per quelli che hanno il sussidio è grandissima, per gl'altri poi ell'è secondo i busti o gusti, come più piace a V.S."). Easter was on 28 March that year (Cappelli 106). Christians could get dispensations from Lent fasting, in Florence, from priests at Santa Maria del Fiore or San Lorenzo only.

[325] See Cappelli 106; *OG* XIX, 183. Advent and Lent were feasts to prepare for Christmas and Easter, through a special diet.

local authorities to regulate commerce in order to provide safe food transportation.[326] Under Doge Niccolò Contarini in the early 1630s, plague epidemics induced the population of Venice to build a new church to thank God for the end of the plague. The church was dedicated to the Madonna of Health ("Madonna della Salute").[327] Given the difficulties in finding and transporting food, corn turned out to be a useful replacement for items that were difficult to buy elsewhere.[328] These notes on Galileo's expenses and diet can enrich our understanding of Galileo's routine, habits, and health while also investigating his thinking and working metaphors based on food. The culture of a historic time lives not only in literary works, but also in material reconstructions and details where the use of numbers adds validity to the material culture preserved in unofficial, serendipitous documents of a distant past. Such details would not be available to our investigation, were it not for Galileo's recorded notes which were collected by Antonio Favaro's monumental edition. Examining Galileo's works and searching for traces of his relationship to mathematics has brought us into food culture and the use of metaphors complementing informal communication with friends and colleagues and the learned discussions present in Galileo's scientific works. Next, a friend of Galileo's assessed nutrition, diet, and daily exercise and rest through scales: I will, then, examine Santorio's work and experimental research.

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[326] Letter on 24 June 1634 (*OG* XVI, 105). As Geri Bocchineri wrote to Galileo about the fish market situation in Venice, "Non mi maraviglio che li dispensieri non habbino mandato il pesce, perchè [sic] ne hanno carestia, et compenseranno (credo io) V. S. in carne, come hanno promesso di fare a noi."

[327] In *Il Pellegrino geografo cronistorico da Napoli sino a Venezia*, Antonio Tommaso Barbaro discussed the plague ("Contagio in Italia, dura quattro anni vi muorono 2667.mila Creature. La Repubblica fa voto d'erigere un Tempio a Maria Vergine, e sotto il Titolo della Salute, e vi spende 100.mila scudi in Fabbrica" Barbaro 563).

[328] Scientific reasoning was important in persuading people of the benefits of the recently imported plant. "Nell'anno 1634, l'agronomo Battista Barpo bellunese loda entusiasticamente la provvidenza perché col grano turco… il povero sostenga agiatamente sè stesso e la sua famigliola, ed il proprietario riempia la borsa di scudi" (Lussana and Ciotto 97).

5. Medicine and the Authority of Books: Santorio's Medical Method.

One of the applications for measuring through scientific instruments was through medicine. Physician Santorio Santorio introduced two practices: measuring the pulse with the 'pulsilogium' and measuring weight with a weighing chair. Santorio Santorio was born in 1561 in Capodistria, which was then part of the Republic of Venice, and he was a medical graduate of the University of Padua (1582). Santorio considered it so important to check diet and weight, that he weighed himself regularly for thirty years. He also collected ten thousand weight records of patients and friends, Galileo included, and was a professor of theoretical medicine at the University of Padua (1611-1624).

The main source for this section is Santorio's book *Ars de statica medicina* ("The Discipline of Weight-Related Medicine," 1614), where he reported observations on diet, weight, and lifestyle.[329] In order to have exact measurements at any time, Santorio used a weighing chair, as seen in the illustration presented in this section. The results of his measuring have two components: a number, and a unit of reference to give meaning to that number – in other words, a number and its unit of measurement. Since a word or phrase acquires different meanings based on the context around it, so numbers gain values according to the units of measurement they refer to. As a consequence of such values assigned to numbers, furthermore, physicians established standards, that is, ideal measurements, and medicine was thus confirmed as the exact distance from two extremes, to achieve Horace's "aurea mediocritas."[330] When we check our weight today, we

[329] I have explored quantitative aspects of the book by Santorio in a forthcoming publication, "Santorio's Medical Method at the Time of Corpuscularism." *La parola del testo, Rivista internazionale di letteratura italiana e comparata*, 2021. For a wider audience, I have written an invited guest blog post "Revealing Data: Ars de Statica Medicina, 1614" in the Revealing Data series, National Library of Medicine blog "Circulating Now," 5 November 2020, https://circulatingnow.nlm.nih.gov/2020/11/05/revealing-data-ars-de-statica-medicina-1614; furthermore, I have developed a digital project, "Santorio's Medical Method" as an insight into the medical method of Santorio (https://scalar.usc.edu/works/science-and-vision/index).

[330] *Carmina*, "Odes" Book II, 10, 5-6: "auream quisquis mediocritatem / diligit," "Who makes the golden mean his guide" (trans. John Conington, 1882).

see a number on the scale. Because we are used to this practice, we know that number corresponds to our weight. Next, we match that number to the current unit of measurement – probably pounds or kilos, depending on where we live and what unit of measurement is conventional locally.[331] Additionally, we can also compare that number to earlier times when we weighed ourselves, and notice possible variations that, we know, correspond to weight gain or loss. How often should we check our weight, though, and why is that important? Santorio had asked himself these questions, too, when he taught theoretical medicine and practiced as a physician in Padua, one of the leading scientific schools in Europe.

Santorio used scientific instruments to find out more about patients' conditions, and at the same time he investigated the structure of matter too. He believed that medical expertise did not derive exclusively from traditional university education, but also from practical experience as a physician. Particularly, he had designed a special scale on which a table and a chair were propped: the so-called "weighing chair" or "Sanctorian chair." He used the weighing chair daily for thirty years: before and after meals, before and after going to the bathroom, and before and after rest, exercise, and sexual intercourse.[332]

[331] For a historical discussion on units of measurement and the search for standards, see Robert Tavernor, *Smoot's Ear: The Measure of Humanity*. New Haven, Conn.; London: Yale University Press, 2007.
[332] See Teresa Hollerbach, "The Weighing Chair of Sanctorius Sanctorius: A Replica" in *N.T.M.* 26 (2018): 121-49.

Figure 8. *Ars de Statica Medicina* (1703 edition). Courtesy of the Wellcome Collection.

Santorio was interested in determining precise measurements of two variables in medicine: weight and time. To record both of them, he used scientific instruments. He devised some scientific instruments in addition to the weighing scale that we have seen: the thermoscope, a wind gauge, and a water current meter. For medical use only, he invented the 'pulsilogium' to measure the pulse rate, as well as an instrument to remove bladder stones, and a trocar to remove fluid from cavities. The 'pulsilogium' was helpful in normal and abnormal clinical state, such as patients affected by the plague who had "weak lungs... and a lesser intensity of the pulse" ("rarum habentes pulmonem... pulsus ictus"; I, 135). He used the hygrometer and thermoscope to check air temperature and humidity and the "weight of the air" ("aeris ponderositas"; II, 4). One of the earliest representations of the 'pulsilogium' was in *Commentaria in primam Fen primi libri Canonis Avicennae* (Venice: Sarcina, 1626: 22).[333] The 'pulsilogium' rationalized a thought process that Galileo himself had used to measure variables in his experiments, for example measuring time during the fall of bodies on an inclined plane, by humming a tune whose length would be considered as a unit of measurement.

Thanks to a new medical method, Santorio legitimized his medical routine in physical examinations of patients. He found it was important to include the concept of time for diet-related information. Time was understood to be an important variable to check health, so that keeping track of it was part of a physician's job. Through these innovations, Santorio introduced a new model and practice in the medical science. Such system of scientific knowledge can be called a 'paradigm', following Kuhn's analysis of scientific revolutions that I discussed in Chapter One. In Kuhn's words:

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[333] See Richard de Grijs and Daniel Vuillermin. *Measure of the Heart: Santorio Santorio and the* Pulsilogium. *Hektoen International* (2017); Fabrizio Bigotti and David Taylor. "The *Pulsilogium* of Santorio: New Light on Technology and Measurement in Early Modern Medicine." *Soc Politica* 11.2 (2017): 53-113.

> At the start a new candidate for paradigm may have few supporters, and on occasions the supporters' motives may be suspect. Nevertheless, if they are competent, they will improve it, explore its possibilities, and show what it would be like to belong to the community guided by it. And as that goes on, if the paradigm is one destined to win its fight, the number and strength of the persuasive arguments in its favor will increase. More scientists will then be converted, and the exploration of the new paradigm will go on. Gradually the number of experiments, instruments, articles, and books based upon the paradigm will multiply (*The Structure of Scientific Revolutions*, Chicago, University of Chicago Press, 1970[2]: 159).

Santorio was aware of his role in modernizing medicine. No one in medicine had achieved a precise quantification of perspiration and its variations before him, and he discussed the novelty of this medical method at length in the Preface to his book *Ars de statica medicina*. The editorial success of the book gives a sense of how popular "The Discipline of Weight-Related Medicine" was, since the book had reprints, in many languages, for more than a century after its publication. The change in the current medical paradigm occurred slowly, through many patients that Santorio observed and many variables considered in a person's health. One of the main novelties in Santorio's medical method was the use of numbers to keep track of information and precise details for useful comparisons in a patient's history, and also among patients that Santorio monitored regarding their weight and daily habits (III, 71 and 76; IV, 29). At that time, in the Venetian area, scholars devoted more and more attention to numbers, because mathematics was a popular discipline at the University of Padua, where Galilei had taught mathematics from 1592 to 1610 and became a famous academic.[334] Galileo had been advocating the use of mathematics and scientific instruments for years. He combined his interest for scientific instruments to an inclination for theoretical and applied mathematics. Making instruments was a source of revenue

[334] In Tomasini's account, Galileo was ranked second to last among professor, and only the professor of rhetorics, Riccoboni, the only academic who was considered less important than him, when Galileo first arrived in Padua (*Gymnasium Patavinum*. Udine: Nicolò Schiaratti, 1654). Mathematics, indeed, was an ancillary discipline for students to learn before they could apply to other fields, usually medicine. Many of Galileo's students at the University of Padua eventually became physicians, thus applying mathematics to other scientific domains.

for Galileo, who was able to sell the compass to students, mostly European noblemen boarding at his house in Padua. In 1597, he had invented a calculating instrument, the geometrical and military compass also known as a sector. Galileo taught how to use scientific instruments to both university students and amateurs who were not pursuing a formal education. Those students were interested in war techniques and needed to learn trigonometry in order to understand ballistics and, thus, use the geometric and military compass correctly. Galileo wrote a treatise on the compass which circulated as a user's manual to instruct clients who bought the compass. The pamphlet was eventually printed in sixty copies at Galileo's home years later (Galileo Galilei, *Le operazioni del compasso geometrico et militare*, Padua, P. Marinelli, 1606).[335]

Once Galileo was in Florence, his friends Paolo Gualdo and Giovanni Francesco Sagredo kept him updated on the local scientific scene. Gualdo had informed Galileo that Santorio was in Venice, in a letter dating back to 1611.[336] Sagredo, a Venetian nobleman, wrote to Galileo about Santorio regarding a new scientific instrument, the thermoscope. Sagredo, who was very interested in science, had managed to produce his own thermoscope after hearing descriptions of it from a friend who had seen a thermoscope in person.[337] Given the common interests in numbers and

[335] A few of Galileo's military and geometrical compasses survive to our days, and one of those is now at the Harvard Collection of Historical Scientific Instruments in Cambridge, MA. Galileo designed that military compass, which Marc'Antonio Mazzoleni, the craftsman living with Galileo, likely produced. That particular compass was inscribed with the coat of arms of the Duke of Mantua, in one of Galileo's attempts to secure a job at Vincenzo Gonzaga's court. Shortly after that inventions, there was an attempted plagiarism and ensuing dispute regarding the sector, and one year after Galileo had published his handbook on the compass, Baldassarre Capra, one of Galileo's students, claimed priority for the invention of the geometric and military compass and published a book in Latin, *Usus et fabrica circini cuiusdam proportionis* ("Use and Construction of Proportional Compasses," Padua: Pietro Paolo Tozzi, 1607). In response, Galileo published the *Defense of Galileo Galilei… against the Calumnies and Pretences of Baldessar Capra* (*Difesa di Galileo Galilei… contro alla calunnie e imposture di Baldessar Capra*. Venice: Tommaso Baglioni, 1607) to address the attempted plagiarism. On the geometrical and military compass devised by Galileo, see https://chsi.harvard.edu /waywiser.

[336] Gualdo wrote from Padua (11 November 1611, "il medico Santorio... stava in Venetia," "the physician named Santorio, was in Venice"; *OG* XI, 230-31).

[337] "Il S.r Mula… mi riferì haver veduto uno stromento dal S.r Santorio, col quale se misurava il fredo et il caldo col compasso, et finalmente mi communicò questo essere una gran bozza di vetro con un colo lungo, onde subito me sono dato a fabricarne de molto esquisiti et belli" (30 June 1612; *OG* XI, 349-51). "Mr. Mula... informed me that he had seen an instrument at Santorio's place, with which one could measure cold and warm by a compass, and eventually he let me know that it was a glass vial with a long neck, which prompted me to produce some of those at once, very

scientific instruments, and the academic community in Padua, it is not surprising to see an exchange of letters between Galileo and Santorio. Santorio was aware that his new book had innovative content, so he sent a letter and a copy of the newly published *Ars de statica medicina* to Galileo, whose opinion he valued (9 February 1615). An author would often write a short statement for a new book both to hear readers' opinions, and to circulate and test considerations on methods. In the letter to Galileo, Santorio introduced his book as follows:

> L'opera è ridotta in afforismi, i quali nascono da due principii certissimi. Il primo è la diffinition della medicina, proposta da Hippocrate nel libro *De flatibus*, dove dice: "Medicina est additio et ablatio; additio eorum quae deficiunt, et ablatio eorum quae excedunt." Il secondo principio di quest'arte è l'esperienza, la quale è prova del resto. Che quest'arte, da me inventata, veramente sii importantissima, è cosa chiara, perchè può distintamente mesurar l'insensibile transpiratione, che, alterata o impedita, secondo l'opinion d'Hippocrate et Galeno, è origine quasi de tutti i mali... lei sola, come dice il nostro quarto afforismo della prima settione, è maggiore de tutti gli escrementi sensibili insieme del nostro corpo (*OG* XII, 140-42).[338]

In the letter quoted above, Santorio introduced weight-related medicine as innovative contents. Traditionally, Santorio wrote his medical book in Latin, the learned language for international scientific communication, and the main sources are also part of the medical reading canon. Hippocrates and Galen are the medical sources whose arguments and methods he included as a foundation to his new medical method, with occasional references to the School of Salerno and its

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precise and beautiful." For further discussions on the thermoscope and intellectual priority, the instrument deriving from Santorio's or Galileo's idea, see Fabrizio Bigotti, David Taylor, and Joanne Welsman, "Recreating the Pulsilogium of Santorio: Outlines for a Historically-Engaged Endeavour," *Bulletin of the Scientific Instrument Society*, 133 (2017): 31-33.

[338] "This book is a collection of aphorisms deriving from two most certain principles. The first one is the definition of medicine as Hippocrates wrote in his book *Of Flatus*: "medicine means to add and to subtract, that means to add things that were missing before and to subtract things that were in excess." The second principle of this art is experience which then becomes the proof for everything else. It is clear that this art, invented by me [*De statica medicina*, "weight-related medicine"] is indeed very important because it can measure precisely the perspiration that we cannot see. Hippocrates and Galen considered perspiration, when altered or hindered, to be the cause of almost every illness... Imperceptible perspiration alone is greater than all the perceptible excretions of our body together, as I argued in the fourth aphorism in the first book of this work" (translation mine).

medical handbook, the *Tacuinum sanitatis*.[339] Through medical aphorisms he wrote in his *Ars de statica medicina*, Santorio connected descriptive generalizations of dietetics to numerical measurements, for a total of five hundred and fifty-two aphorisms.

The text is divided into seven books on the topics of imperceptible perspiration (Book I), air and waters (Book II), eating and drinking (Book III), sleeping and being awake (Book IV), exercise and rest (Book V), sexual intercourse (Book VI), and emotions (Book VII). In the first two aphorisms, Santorio established useful definitions and parameters (I, 1) and warned doctors about imperceptible perspiration, without which knowledge one would deceive his patients (I, 2). Santorio's routine as a physician changed, in consideration of medical values that he could measure and, in the case of imperceptible perspiration, one could infer its existence and measurement by calculating the difference from recorded weights of patients and meals. While it might seem natural today to see connections between diet, exercise, and wellness, a physician's practice did not include attention for bodily weight before Santorio introduced his new medical method.[340] Though the reference to numbers may sound trivial with regard to weight (I, 79 and 114), it is through numbers, too, that Santorio attempted to categorize time as a medical factor to consider and describe in medical logbooks (III, 94 and IV, 34).[341] Keeping track of time as a valid variable was an innovation, too, in experimental research. One of the first recorded variables was the pulse, through an instrument called 'pulsilogium' or pulse-measurer. According to Santorio, a good physician needed to learn from experience. Such experience was not a spontaneous flow of facts, but an organized and planned way of observing reality and keeping track of it in writing, when the

[339] For the impact of *Tacuinum sanitatis* on medical knowledge and Italian literature at Boccaccio's time, see Laura S. White, *Seduzione e privazione. Il cibo nel Decameron*. Lucca: Pacini Fazzi Editore, 2016.
[340] Kuriyama called Santorio "the first – and this surely is the most crucial point – to advance the key justification for this practice: to urge some vital connection between the numbers read off a scale and a person's state of being" ("The Forgotten Fear of Excrement." *Journal of Medieval and Early Modern Studies* 38.3, 2008: 416).
[341] Kepler "still considered the pulse's record as a reliable timekeeper for astronomical observations" (Bigotti 31).

observer intentionally measured a number of variable medical facts related to diet. From plenty of case studies and examples, both personal and patients', Santorio demonstrated how important it is to understand how, when, and why you should check your weight in the pursuit of good health.

By collecting medical data and writing theoretical reflections on such data, Santorio recorded his clinical experience and summarized those findings for the benefit of his fellow physicians and readers. Such decisions derived partly from the establishment of a new scientific method and the use of scientific instruments, scales included. In particular, Santorio started his discussion by noticing changes between recorded daily weights (I, 73 and 81; II, 23, 41, 52; III, 37). He also noticed density differences between liquid and solid foods (III, 64), as well as changes in imperceptible perspiration after eating specific foods, such as pork, mushrooms (III, 24), or watermelons (III, 25). He kept track of day-to-day differences in weight (I, 16) and realized that imperceptible perspiration and all other excretions affect health as much as other factors traditionally recorded in medical practice (I, 4). As a result of measuring patients' weight, and his own, on the weighing scale, Santorio intended to provide an improved description of matter, including solid and non-solid ("imperceptible") matter alike.

Imperceptible perspiration, a variable that one cannot see nor feel, was an understudied element to analyze. It would vary based on seasons, age, diseases, diet, and non-naturals (I, 7).[342] He was aware that imperceptible perspiration both affected a person's weight, the balance of humors, and consequently health (I, 65) after he noticed its effects, when imbalanced, in patients' health (I, 60). Next, he would compare a healthy and sickly condition for a patient, and consider how specific diets, physical activity, and habits hindered a regular imperceptible perspiration.

[342] For the purpose of clarity, I use Roman ordinal numbers to refer to the book number in Santorio's *Ars de statica medicina* and Arabic numbers stand for the aphorism. The English translation is cited from *Medicina statica: being the aphorisms of Sanctorius*, ed. Quincy. London: J. Osborn, T. Longman, and J. Newton, 1728[4]. Translations of the Preface are mine, though, because that section was not included in Quincy's translation.

Santorio introduced a closer analysis of imperceptible perspiration because he considered it to be one fundamental medical variable to check in a patient, and he delineated a health program thanks to numerous practical measurements of such perspiration. Santorio took in consideration mealtimes, exercise, and any physical activity to check both physical and psychological health – all with the help of a scale. He said that the best time to eat is "when the body comes to some healthful standard, as it enjoyed the day before, when empty: but that Apollo himself cannot find out, without the balance" (III, 77). Santorio laid theoretical foundations based on experience and the observation of a patient's daily life and weight. As a writer, he shared his observations as aphorisms in which he explained the weight measured with it and, most importantly, variations in weight measurement associated to clinical variables.

Ironically, Santorio stated that everyone needs a scale to know weight, even Apollo, one of the gods traditionally associated with medicine and divination. In order to notice patterns and variations in weight, Santorio invented and used a scientific instrument to study weight and measure imperceptible perspiration: the weighing chair, of which I showed an etching representing it, from the 1703 edition of his book.[343] In the illustration, Santorio appears to be sitting in a chair that is much higher than usual, which in turn connects to a scale mechanism. In front of Santorio, there is a meal set on a table which stands on a platform.

In order to measure something that is not perceptible with senses, Santorio needed to work around the lack of sensorial evidence. He thus weighed meals and himself, or patients before and after eating, sleeping, exercising, and bodily functions, as mentioned earlier. He also needed to discuss the new medical method, and medical variables, as theories and concepts that are medical as well as philosophical, given that imperceptible perspiration is an elusive element to measure.

[343] There is no known attribution for artists and craftsmen who made the illustration.

One can still measure it, though, after measuring other variables in a patient's daily routine. Thanks to this medical method, Santorio opened a new field of studies for imperceptible perspiration because neither philosophers nor physicians had attempted that study of medical properties and facts before.[344]

In terms of thinking modes and philosophy, Santorio derived suggestions for advantages and disadvantages in a diet from the theories of Epicurus, a philosopher who had recommended how to attain self-control and happiness. When one plans diets, one should consider advantages, or damages that could follow. As Epicurus had argued,

> While therefore all pleasure because it is naturally akin to us is good, not all pleasure is worthy of choice, just as all pain is an evil and yet not all pain is to be shunned. It is, however, by measuring one against another, and by looking at the conveniences and inconveniences, that all these matters must be judged... Plain fare gives as much pleasure as a costly diet, when the pain of want has been removed, while bread and water confer the highest possible pleasure when they are brought to hungry lips (*Letter to Menoeceus*, ed. R.D. Hicks, Adelaide, The University of Adelaide Library, 2004).

In addition to philosophical considerations and advice on lifestyle, Epicurus had also suggested that matter is made of small units that he called 'atoms' ('atomoi', meaning 'indivisible' in Greek) that are the smallest existing unit of matter. When Lucretius developed a Latin version of such theories by Epicurus, he talked about corpuscles ('corpuscula') as the structure of matter and the basic units for everything that exists in nature. Lucretius promised to demonstrate "in verse how corpuscles of stuff, from everlasting and today the same, uphold the sum of things, all sides around by old succession of unending blows" (*Lucretius. A Metrical Translation*, ed. W.E. LEONARD, London: David Campbell Publishers, 1921, II, 528a-29).[345] Everything is made of corpuscles in

[344] "Novum atque inauditum est in medicina posse quempiam ad exactam perspirationis insensibilis ponderationem pervenire: nec quispiam philosophorum, nec medicorum unquam hanc medicae facultatis particulam aggredi ausus est." See also Santorio III, 71 and 76; IV, 29.

[345] "[…] versibus ostendam corpuscula materiai / ex infinito summam rerum usque tenere / undique protelo plagarum continuato."

nature: both physical things that one can touch, and incorporeal things such as light and steam. Corpuscles, though tiny, can move and change other substances, which should not surprise us: "Nor yet in these affairs is aught for wonder that particles so fine can whirl around so great a body and turn this weight of ours" (IV, 898-900).[346]

Once we consider that contact and interaction occur at the level of the corpuscles, it is possible to understand the interaction between two substances, according to Lucretius: "Therefore, when iron (which lies between the two) hath taken in some atoms of the brass, then do the streams of that Magnesian rock move iron by their smitings" (VI, 1063-64).[347] Because matter is made of corpuscles, all substances are physical. Those corpuscles exist both individually and as conglomerates. Space, in turn, is made of physical matter and there is, consequently, no void. That means that even incorporeal-looking phenomena, such as light, occur within space. Lucretius commented about the propagation of light and heat through matter, as is clear from the case of sunlight, as follows: "if those fine particles of things which from so deep within are sent abroad, as light and heat of sun, are seen to glide and spread themselves through all the space of heaven upon one instant of the day" (IV 199-201).[348] Lucretius also stated that "[…] the sun's warm exhalations and this serene light travel not down an empty void... nor one by one travel these particles of the warm exhalations, but are all entangled and enmassed" (II, 150-56).[349]

If you know the shape, properties, and motions of corpuscles, in nature and in the human nature that is the human body, you can understand the structure and properties of matter. Santorio assumed the existence of the smallest units that one could measure, visible or not, and the existence

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[346] "[…] nec tamen illud in his rebus mirabile constat, / tantula quod tantum corpus corpuscula possunt / contorquere et onus totum convertere nostrum."
[347] "[…] interutrasque igitur ferri natura locata / aeris ubi accepit quaedam corpuscula, tum fit".
[348] "[…] si quae penitus corpuscula rerum / ex altoque foras mittuntur, solis uti lux / ac vapor, haec puncto cernuntur lapsa diei."
[349] "[…] vapor... lumenque serenum... non per inane meat vacuum... nec singillatim corpuscula quaeque vaporis / sed complexa meant inter se conque globata."

of corpuscles in the medical field is part of a theory called 'corpuscularism'. From antiquity, beliefs in corpuscles became more influential once humanists rediscovered classical texts by Lucretius which revived Epicurean theories. Medical corpuscles are entities, as atoms and corpuscles are in the theories of Epicurus and Lucretius respectively, whirling in a godless universe. For Santorio, the discussion of medical corpuscles did not pertain to theology or ethics, though. He intended to measure changes in weight, compare quantified units of weight, and interpret variations that were unnoticed before – and to determine and measure imperceptible perspiration. Galileo might also have supported atomism, as Pietro Redondi has argued.[350]

In medical studies by Santorio, imperceptible perspiration ('perspiratio insensibilis') corresponds to the losses that are not included in bodily waste or sweat. One can measure that perspiration by comparing the patient's weight to the weight of meals and bodily fluids and excretions. In order to have exact measurements of himself at any time of the day and night, Santorio used the so-called 'weighing chair' and kept notes of the recorded weights and variables such as the time of the day, the amount and type of food and drinks ingested, the patient's exercise or rest, and so on. By doing so, Santorio made it possible for numbers associated to units of weight measurements to become medical data to study and interpret. For the sake of precision, Santorio mentioned specific quantities of food and liquids, as well as the lack of nutrition during fasting (IV, 20). He noticed differences in imperceptible perspiration caused by sexual intercourse (III, 79, 82; VI, 2), sleep (IV, 1-2, 4, 12, 28; IV, 4, 7, 54, 56; restless sleep, IV, 5), as well as the overall difference in perspiration when asleep and awake (IV, 18-19), or napping as opposed to regular night sleep (IV, 31 and 37). One should avoid any excess and aim for a balanced middle way (VI,

[350] On atomism in the early modern period, see Federica Favino, "A proposito dell'atomismo di Galileo: da una lettera di Tommaso Campanella ad uno scritto di Giovanni Ciampoli." *Bruniana & Campanelliana* Vol. 3, No. 2 (1997): 265-82.

43, 46, and 48). Therefore, it is not recommended to have four pounds of food at once, but it is fine to have that amount in two or three meals (III, 88). Overall, maintaining a regular weight is important (I, 15 and 69) because it helps promote health and for longevity (I, 123; III, 41; III, 90), a recommendation that dated back to the text by Roman physician Celsus (II, 12 and III, 4).

All of Santorio's aphorisms address imperceptible perspiration and its weight. Qualitative descriptions of traditional humors in medicine were still important (for example, see III, 23, 45-48), but quantitative measurements gained a privileged status in Santorio's medical discussions. Since Santorio followed so many patients' diets and daily weight fluctuations, he could find recurring patterns and establish general principles based on the weights he measured and the integrated reflections on qualitative aspects of the patient's lifestyle and habits. One can see a range of recommended food amounts for people, based on their age, gender, and physical activity: "[…] that quantity of food to everyone is most healthful, which without any uneasiness can be perfectly digested: and that it is perfectly digested, may be known by the sum of the evacuations answering the quantities taken in; which will appear by weighing" (III, 38).[351] Two generations earlier, a nobleman and scholar based in Padua, Alvise Cornaro, had promoted the idea of a sober lifestyle through his popular example, and book. He believed that "no one can be a perfect physician for someone else than himself", as he stated in his book "Dialogues on the Modest Life" (*Discorsi della vita sobria*, Venezia: Marc'Antonio Brogiollo, 1620: 26-27).[352] Cornaro was interested in human wellbeing, as well as the literary and visual arts to bring beauty into one's experience, and as such he was the patron of Angelo Beolco, alias Ruzante, a playwright who wrote in the Paduan dialect, and of the architect Giovanni Maria Falconetto, from whom he

[351] For the concept of metabolism, see D. F. Harris, "The Date of the Introduction of the Term 'Metabolic'," *Nature* 98 (1917): 389–390.

[352] "[…] proprietà occulte... io con la lunga osservanza, a pena le ho potute avertire, & ritrovare? Però non può alcuno essere perfetto medico d'un'altro."

commissioned the Loggia and Odeo Cornaro that was the first Renaissance building in Padua and an innovative building for modern theater.[353] Cornaro had used his experience and frugal diet to show how radical choices could become routine and improve one's health. One could have approximately twelve to fourteen ounces of bread, yolk, meat, and soup, and fourteen to sixteen ounces of wine daily.[354]

Santorio also studied digestion, a fundamental process in which food impacts both the digestive system and the brain, after studying meals and liquids in a daily diet. He believed that there is a correspondence ("sympathia") between stomach and brain. Digestion can affect sleep quality, for example: "[…] nothing more frequently interrupts sleep than a putrefaction of the food: such as this sympathy between the stomach and the brain" (IV, 40).[355] Though doctors often used laxatives to solve digestive problems momentarily, Santorio criticized those physicians who took care of purgation without first considering imperceptible perspiration which is fundamental to understand medical corpuscles (I, 61). Similarly, general remedies are not always helpful for everyone, so it was necessary for the physician to understand internal as well as external factors to promote and maintain health, so he had specific recommendations for royal patients who tended to have other habits and diets that befitted their social status (III, 75).[356] Imperceptible perspiration was not, however, the only immaterial factor to consider. Emotions, too, could alter bodily functions, too. Santorio believed that "a passion of the mind is not to be conquered by medicine, but by some contrary passion" (VII, 12), thus following the traditional principle of curing by opposites ("contraria contrariis curantur").[357] Hidden qualities in nature, Santorio argued, could

[353] See Ludovico Zorzi, *Il teatro e la città*. Torino: Einaudi, 1977.
[354] Santorio quoted the medical school of Salerno only once, about drinking wine (III, 78).
[355] "Nulla causa saepius somnum interturbat, quam ciborum corruptela: id efficit quae est inter stomachum et cerebrum sympathia."
[356] A general recommendation, instead, was necessary during plague epidemics, when isolation was to be enforced for people of all social classes (I, 2 and 138).
[357] "[…] passio enim animi non medicinis, sed alia passione contraria superatur."

affect weight and cause fluctuations in weight. In the book section *De cibo et potu* (on food and drink), Santorio noticed differences between foods, as well as their impact on physical and emotional health.

While Santorio's book preserves textual instructions for a range of recommended foods, based on a person's age, gender, and physical activity, the book illustrations published over one hundred and fifty years show an evolving perspective of the patients and what they choose to have on the table.[358] All of Santorio's medical observations on diet, digestion, and weight are presented in a collection of aphorisms in *De statica medicina*. Those statements are clear, concise, and therefore easy to memorize. The genre of aphorisms dated back to Hippocrates, whose aphorisms had been a basic reading for would-be physicians for several centuries. In the Preface, Santorio argued that short, memorable sentences are better than analytical expositions, so that aphorisms seemed to be the best form to convey his medical considerations.[359] With such style of writing, the author guided readers and students, making later references to the book easier to find. Students would learn by reading, repeating, and passing exams on expressions by Hippocrates, traditionally considered to be the father of medicine, and Santorio chose that style of writing because classical texts remained an authoritative presence in medical education in the early modern period.

Santorio organized his medical aphorisms in a remarkable order, imitating (he wrote) the same way bees first collect honey from many flowers and then deposit it in beehives. Santorio argued that bees worked according to an order that they had designed and tested as effective. He thus wished "[…] to expose aphorisms connected one to the other in an remarkable order, almost the same way in which bees first taste honey from various flowers, and then they lay out elaborated

[358] In my digital humanities research, I explored IIIF implementations to study early modern scientific images (https://iiif.io).
[359] "[…] doctrina aphoristica quam diexodica describere."

honey in their beehives with an extraordinary order."[360] This simile about bees and honey had originated in Latin literature, specifically in a passage from a letter by Seneca: "We should follow, men say, the example of the bees, who flit about and cull the flowers that are suitable for producing honey, and then arrange and assort in their cells all that they have brought in; these bees, as our Vergil says, 'pack close the flowing honey, / And swell their cells with nectar sweet'" (*Ad Lucilium epistulae morales*, ed. Gummere, Cambridge, MA, Harvard University Press, 1989-1991; XI, 84, 3).[361] If we imitate the patience and resilience of bees, we can collect materials in a structured way, Seneca seemed to suggest.[362] By expanding on that concept, Santorio showed both humanistic and medical interests. Intellectual skills, he wrote, allow us to expand and enrich the understanding of nature "[…] by applying the supervising care with which our nature has endowed us, – in other words, our natural gifts, – we should so blend those several flavors into one delicious compound

[360] "[…] optime inter se connexos miro hoc ordine digesserim, eo plane modo quo apes primum mel ex variis floribus delibant, et deinde in apiariis per aedicularum suarum favos elaboratum miro ordine disponunt" (from Santorio's Preface). Translation mine.

[361] "Apes, ut aiunt, debemus imitari, quae vagantur et flores ad mel faciendum idoneos carpunt, deinde quidquid attulere disponunt ac per favos digerunt et, ut Vergilius noster ait, 'liquentia mella / stipant et dulci distendunt nectare cellas.'" That metaphor had influenced also Francesco Petrarca's writing, as reconstructed recently in Roberta Antognini, *Il progetto autobiografico delle* Familiares *di Petrarca*, Milano, LED, 2008: 31: "Benché Petrarca conoscesse le *Ad Lucilium* di Seneca, è la scoperta delle lettere di Cicerone a suggerirgli l'idea per il suo epistolario." Furthermore, see pp. 63-76 on literary models, including Seneca; pp. 125-125, for the letters sent by Francesco Petrarca to Tommaso Caloiro (I 7-9): "[…] testimoniano l'impegno umanistico di Petrarca attraverso il rifiuto della tarda scolastica e la trattazione di due temi, quali il processo dell'invenzione letteraria, e lo studio del *sermo* (forma) indissolubilmente legato all'*animus* (contenuto). Nell'esporre la teoria dell'imitazione, Petrarca fa subito in apertura, un'importante dichiarazione di poetica, che verrà poi più volte riproposta nel corso della raccolta: […] 'apes in inventionibus imitandas, que flores, non quales acceperint, referunt, sed ceras ac mella mirifica quadam permixtione conficiunt' (I, 8, 2 cf. *Ad Luc*. 84, 3, 5). Bisogna, cioè, leggere e studiare i classici rinnovandoli nella nostra rielaborazione. A questa *reductio ad unum* da fiori al miele, Petrarca fa riferimento anche nella lettera seguente (I 9), in cui tratta dell'eloquenza. Il legame tra *animus* e *sermo*, collegato all'ideale stoico del saggio, è espresso in termini agostiniani, che rimandano a quel conflitto della volontà (al volere e non potere perché non si vuole con sufficiente determinazione) che è alla base del "dissidio" e dell'intera produzione letteraria di Petrarca, dai *RVF*, al *Secretum*, agli epistolari in prosa e in versi."

[362] In one letter, Seneca argued, firstly, that human bodies respond to natural laws, and secondly, that it is important to take care of one's diet and digestion, as life and intellectual skills derive from digestion. He wrote: "This is what we see nature doing in our own bodies without any labour on our part; the food we have eaten, as long as it retains its original quality and floats in our stomachs as an undiluted mass, is a burden; but it passes into tissue and blood only when it has been changed from its original form. So it is with the food which nourishes our higher nature, – we should see to it that whatever we have absorbed should not be allowed to remain unchanged, or it will be no part of us" (Seneca XI, 84, 5-6).

that, even though it betrays its origin, yet it nevertheless is clearly a different thing from that whence it came" (Santorio's Preface). Santorio elaborated more arguments from Seneca's writings, for example regarding plagiarism and dishonest intellectuals that he mentioned in the preface to *De statica medicina*.[363] By merely copying ideas, one gets a copy that is far removed from the achievements of the original work because "[…] even if there shall appear in you a likeness to him who, by reason of your admiration, has left a deep impress upon you, I would have you resemble him as a child resembles his father, and not as a picture resembles its original; for a picture is a lifeless thing" (Seneca XI, 84, 8).[364]

An opponent of Santorio's work was Ippolito Obizzi, who published a book titled *Staticomastix sive staticae medicinae demolitio* (*The Scourge of Weighing, or the Demolition of Static Medicine*) against Santorio's medical method and theories in 1614. One might suspect that, in the Preface, Santorio was addressing Obizzi's criticism. It seems that Santorio considered controversies related to *De statica medicina* to be caused by envy for his own academic standing and research. In his opponent's book, one finds many of Santorio's foundational values, though criticized and at times ridiculed. Obizzi warned his readers, in his Preface, that there is no novelty, revolution, hope or benefit in Santorio's method (*Ars Sanctorii Sanctorii de statica medicina: aphorismorum sectionibus septem comprehensa*, Lipsiae, Schürer, 1614: 1).[365] Urged by disagreement with Santorio and a love for truth, Obizzi staged a dialogue between the personifications of Galenic medicine and Static medicine. Galenic medicine's youngest rival was

[363] "For some authorities believe that bees do not possess the art of making honey, but only of gathering it" ("Quibusdam enim placet non faciendi mellis scientiam esse illis sed colligendi"; Seneca XI, 84, 4).
[364] "Etiam si cuius in te comparebit similitudo quem admiratio tibi altius fixerit, similem esse te volo quomodo filium, non quomodo imaginem: imago res mortua est."
[365] "[…] res novae... nec spes ulla, nec qualiscumque fructus."

the unflattering personification of Santorio's Static medicine, as Obizzi had decided to depict it with contempt.

By referring to numbers and quantities explicitly, Santorio also enabled both physicians and patients to check the situation for themselves regarding medical matters, and report to physicians for a case-by-case medical care. Those who read Santorio's medical aphorisms could follow those directions and, therefore, confirm the value of the new medical method "not only thanks to mind and understanding... but also with one's eyes... as if they could touch with their own hands."[366] In a strategic position such as the preface is, Santorio also stated the metaphorical weight, that is, the importance, of knowledge regarding the imperceptible perspiration and the consequences in personalized medical practice.[367] His use of rhetorical devices such as aphorisms, metaphors, and references to classical sources strengthens the contents he was expressing because numerical approaches to medicine had not been common practice before Santorio.

The support of authoritative medical texts was part of his writing strategies and scientific discourse and Santorio often acknowledged ideas that he derived from classical authors. Classical sources have not provided frequent confirmations for the validity and use of numbers. There was not any cultural uniformity regarding the use of numbers in written texts, apart from a cursory reference found in the Biblical book of *Ecclesiastes* where it was argued that everything is found in weight and number (*Ecclesiastes* 11:21). Authors used numbers sparingly in their books, even in technical and medical ones. For Santorio, instead, numbers became important carriers of meaning, particularly in medical contexts, and Santorio often mentioned quantities in his aphorisms as important carriers of meaning in medicine. He referred to quantities precisely, based on his experience in many aphorisms (I, 6, 56, 58-59, 72; III, 1, 4-5, 8-10, 35, 68-69). Among

[366] "[…] non solum animo et intellectu... sed oculis etiam... quasi manibus palpent" (from the Preface by Santorio).
[367] "[…] quantum in medendo ponderis habeat insensibilis perspirationis cognitio" (Preface).

Santorio's results were an estimate of the ideal amount of food to eat every day, an ideal time for resting and sleeping, and an ideal proportion between ingested food and imperceptible perspiration. Additionally, Santorio suggested a thought experiment for patients to understand that thirty-five ounces of food is the desirable intake (I, 64).

When Santorio gave advice on diet, food absorption, and digestion, he presented a new medical method. Thus, he found validation for his theories both in medical experience and in classical texts.[368] He referred to Hippocrates and his aphorisms, but also Asclepiades as a main medical example, as delineated in the accounts of Pliny the Elder and Celsus. Asclepiades was not only a physician interested in diet, but also a supporter of corpuscular theories. He believed in "indivisible particles" which he derived from Heraclides Ponticus, according to Elizabeth Rawson ("The Life and Death of Asclepiades of Bithynia." *The Classical Quarterly*, 32, 2, 1982: 358). According to Pliny the Elder's account on the history of medicine, Asclepiades of Prusa had "the highest reputation… for having founded a new school... but most of all for having made a wager with fortune that he should not be deemed a physician if he were ever in any way ill himself" (*Natural History*, ed. Rackman and Jones. Cambridge, MA, Harvard University Press, 1938, Book VII, ch. 124).[369] Asclepiades recommended "especially five principles of general application: fasting from food, in other cases abstinence from wine, massage, walking, and the various kinds of carriage-rides." Patients felt empowered because they could feel that health was within their reach: "Since every man realised that he could provide these things for himself, and since all

[368] Claire Crignon studied British scientists who both admired classical texts, as well as scientific experiments. Crignon argued that the relationship between scientists and books is central, as «it is necessary to define a kind of empiricism that would be able to "reintroduce philosophy inside medicine," a kind of inquiry into the nature of bodies that will not give up on the investigation into the causes of diseases» ("The Debate about *methodus medendi* during the Second Half of the Seventeenth Century in England: Modern Philosophical Readings of Classical Medical Empiricism in Bacon, Nedham, Willis and Boyle." *Early Science and Medicine*, 2013: 350-51).

[369] "[…] summa autem Asclepiadi Prusiensi condita nova secta... maxime sponsione facta cum fortuna, ne medicus crederetur, si umquam invalidus ullo modo fuisset ipse." For a modern account on Asclepiades, see R. M. Green, *Asclepiades: His Life and Writings*, New Haven, Licht, 1955.

applauded him as if the easiest things were also true, Asclepiades brought round to his view almost all the human race, just as if he had been sent as an apostle from heaven" (Pliny XXVI, 13).[370] The five principles of general application found immense favor among patients at Asclepiades', and then Santorio's, time, and those medical tenets would be part of recommended diet practices because it was easy and pleasing to follow those recommendations.

A Roman doctor, Celsus, had also examined Asclepiades's methods: "Asclepiades said that it is the office of the practitioner to treat safely, speedily, and pleasantly. That is our aspiration, but there is generally danger both in too much haste and too much pleasure" (III, 4).[371] Asclepiades devoted attention to diet, fasting, and selection of fasting, food, and the use of laxatives. He concentrated on digestion first to promote healing and "did away with medicaments; he did not clyster the bowel with such frequency but still he generally did this in every disease" (III, 4).[372] Asclepiades, however, prescribed strict fasting for three days and would allow food on the fourth day (Celsus, *On Medicine,* ed. Spencer. Cambridge, MA: Harvard University Press, 1935, Book III, ch. 4).[373] Celsus also concentrated on the importance of dietetics, pharmaceutics, and digestion ("concoctio"; *Prooemium* 9, 20-21). Santorio discussed Celsus' statements relating to foods and digestion carefully, only once disagreeing with the immoderate use of the six non-naturals, whether scarce or excessive (Santorio III, 42). The early modern belief in corpuscularism was based on classical sources such as Asclepiades, Celsus, Pliny and Lucretius, as well as on experimental

[370] "[…] quinque res maxume communium auxiliorum professus, abstinentiam cibi, alias vini, fricationem corporis, ambulationem, gestationes, quae cum unusquisque semet ipsum sibi praestare posse intellegeret, faventibus cunctis, ut essent vera quae facillima erant, universum prope humanum genus circumegit in se non alio modo quam si caelo demissus advenisset."
[371] "Asclepiades officium esse medici dicit, ut tuto, ut celeriter, ut iucunde curet. Id votum est, sed fere periculosa esse nimia et festinatio et voluptas solet."
[372] "Asclepiades medicamenta sustulit; alvum non totiens sed fere tamen in omni morbo eius uti professus est."
[373] "Asclepiades ubi aegrum triduo per omnia fatigarat, quartum diem cibum destinabat." On foods that stop nausea and stimulate appetite, see Celsus III, 6, 11.

evidence from patients' records and Santorio's own weighing chair. Imperceptible perspiration would vary based on seasons, age, diseases, diet, and non-naturals (I, 7).

By considering advantages and disadvantages in diet choices, one should remember that "whichever food you take a smaller amount of, it is a healthier weight" (III, 33).[374] Santorio was able to integrate theories of Celsus and Asclepiades through the comments of contemporary physicians and scholars interested in botanical studies: Hieronymys Mercurialis, Ercole Sassonia, and Prospero Alpini. Mercurialis had explained the importance of corpuscles in medicine: "following Democritus's interpretation, Asclepiades taught that diseases enter from atoms' structure into empty passages, and showed how blockages occur, calling this entry, or merging, 'enstasis'; he first got this idea from Celsus, who in the preface to his books reports that Asclepiades claimed that diseases occur when wandering corpuscles block passages, standing, through invisible pores" (*Variae lectiones*, Paris, Nivellius, 1585, IV, XII, p. 114).[375] Another contemporary doctor, Ercole Sassonia, also commented on Asclepiades's mild, pleasant remedies in a book on vasoconstrictors ("Asclepiades. . . was the first to change traditional medicine, and wanted to remove all suffering, and thought of various mild remedies appealing to patients – for example, hanging beds, baths, cold drinks, and other things of this kind in order to soothe the spirit of sick patients" *De phoenigmis libri tres,* Patavij, Meiettus, 1593: 5).[376] Alpini also reconstructed the methods of ancient physicians from the perspective of the history of medical practice (*De medicina methodica libri tredecim*, Padova, F. Bolzetta, 1611, in particular Book II, chapters 2

[374] "[…] quod vero detur minus, et maius salubre pondus."
[375] "Asclepiadem, qui Democritum secutus morbos ex atomorum in vacuos meatus ingressus, obstrusioneve gigni docuit, huiusmodi ingressum, infixionemve enstasin verosimile est vocasse: quod primo colligitur ex Celso, qui in prohemio librorum suorum tradit Asclepiadem contendisse fieri aegritudines ubi manantia corpuscula per invisibilia foramina subsistendo iter claudunt."
[376] "Asclepiadem... qui primus veterem medicinam immutauit, & cruciatus omnes detrahere voluit, ac blandimenta varia, lectos inquam pensiles, balnea, frigidae potum, atque alia id genus ad aegrotantium demulcendos animos excogitauit." The English translation is mine.

and 6). Thus, by relying on classical and contemporary scholarly literature, Santorio renewed methods in medical practice and introduced measurement in medical practice. He ascertained that it was fundamental to check those health facts in good medical practice, after many observations of patients and scales, and believed it was important to describe quantities in a precise way, and to give advice accordingly. Santorio's medical method included both measurements to give precise quantities of medical facts, and classical textual sources in medicine and corpuscularism to justify new medical practices. The cultural values of humanism were part of scientific culture, as seen in the previous chapters, and of medical thinking, too.

6. Quantitative Tools in the Humanities: Digital Analysis in Galileo's Works.

As I have discussed in this chapter, quantification became an adequate rhetorical strategy, moving from the field of mathematics and applied sciences to texts and visual illustrations in print. When Santorio and Galileo introduced numbers, measurements, and time keeping into their works, describing became a cultural value. With those values in mind, I decided to use quantitative tools and apply them to text analysis for a sample study of scientific vocabulary in the corpus of Galileo's writings. Digital humanities methods in quantitative text analysis have allowed me to check for textual occurrences and the relative proximity of words in Galileo's, and Marino's works respectively.

An analysis system called word vectors is designed to yield results especially when tested in collections of texts of one million words and above.[377] Furthermore, the method of word embedding models examines available data in textual form. By looking at texts as collections of words with meaningful connections among them, word vector technology analyzes patterns, anticipates congruity, and indicates unexpected verbal proximities. My research advances understanding of scientific and technical literature by analyzing a variety of authors through the lens of scientific genre in the selected timespan applied to my doctoral research, in which the language is mostly Italian, with occasional Latin passages from classical texts. For a balance of scientific treatises and poems, I built a corpus with a selection of Galileo's main works and Marino's Baroque poem, *Adone*, permeated by science enthusiasm and particularly Galileo in the tenth poem section. The mixed genres correspond to a situation where prose prevailed, and poetical

[377] To think of one example from everyday life, movie subscription services such as Netflix and Hulu suggest movies that we could like. Under the categories of "best picks for you", "you might also like", and so on, we get recommendations that seem a generous guess and a deep reading of our tastes, but which is actually based on what movies we watched, the movie genre, and the time of the day. All of this is achieved by running our analytics through machine learning and algorithms.

renderings existed alongside prose, both in the form of celebratory writing and in a didactic form. My research corpus, thus, is a collection of early Italian scientific, medical, and autobiographical manuscripts. My digital corpus contains 1,039,821 words in twelve different documents. I assembled my corpus by copying and pasting texts from the National Edition of Galileo's works, edited by Antonio Favaro, and from the Hathi Trust Digital Library. Cleaning and regularizations were necessary digital transformations from the assembled plain-text version, so that I could have a set of documents in some machine-readable form.[378]

Before starting a project on text analysis, it is common practice to try a brief exploration of the corpus using Voyant Tools (https://voyant-tools.org). Using that webtool, I could generate a word cloud of the top forty-five terms, and I tried that approach for a sample of my corpus, Galileo's *Dialogo sopra i due massimi sistemi del mondo* 1632), the book that caused conflicts with the Church, eventually leading to the Inquisition trial in 1633. The book has 177,492 words. The forty-five most frequent words are shown in this word cloud visualization: "terra" (Earth), "moto" (motion), "esser" ("being"), "sole" ("Sun") and "luna" ("Moon") are among the most common occurrences of nouns expressing things and ideas.

[378] Since the majority of my texts are in Italian, defining stop words was a trial-and-error procedure to check what would work best in digital analysis. First, I filled in the pair word list in English, traditionally used in word vector analysis, and I gave a translation of those terms in Italian. Next, I found modern-day Italian stop word lists on GitHub (https://github.com), and integrated those with other, equivalent terms, and also alternative spellings that would be acceptable in pre-standardized, early modern Italian writing. One example of word vectors in non-contemporary literature is found in seventeenth-century values of credit and authority in Sarah Connell's research and in eighteenth-century literature in Ryan Heuser's studies. I would like to thank Laura Johnson, a Graduate Research Assistant (Northeastern University) who helped me to work towards the model to enter into the word vectors model. I used the Word2Vec tool developed by Northeastern University, which was made available to me for research purposes. I also wish to thank Sarah Connell and Julia Flanders for hosting my project on the Women Writers Project webpage and sandbox, and for their feedback on my findings.

Figure 9. Word cloud generated through Voyant Tools. Textual visualizations through statistical tools are helpful in exploratory phases of a textual corpus – here, Galileo's.

The persuasion offered by such exploratory tools is provisional. Still, the use of technology, numerical significance, and visualizations contributes ideas on major tendencies, and may point to new directions, silences and absences included. For the corpus of scientific texts, some of my preliminary questions had the following perspectives: When did scientific language become standardized in Italian? How does humanistic and scientific communication relate to authority and logical arguments? What associations are present between subcategories for science disciplines? For instance, what language justified the emergence of astrology as a less legitimate branch for astronomy? To answer those questions, I researched the National Edition of Galileo's works curated by Antonio Favaro (1890-1909), and got access to the collected, curated texts that have become the standard for works by Galileo and works related to his works. Entering text analysis with word vectors has helped me retrace and pinpoint scientific communication in the early

modern period. At this point, once I had a computer-readable model of my research corpus, I could rely on a representation of those texts, in the form of a processed representation of the textual data contained in those documents.

Vectors and vector models are important to understand elements and characteristics of a collection. Not only the presence of certain words, but also the absence is something that is important to note. As a matter of fact, semantic proximity translates to proximity in vector space. To give some context on the digital methods and tools, a vector is a line that has both a specific length and a specific direction or orientation in space. In a word-embedding model, the model represents a text corpus so that, in a certain sense, each word projects some meaning, based on its position and proximity in vector space. In word-vector analysis, a window is a span of text of a specified length, whose size is controlled by setting parameters. To test contexts in lexical and syntactic circumstances, I have been experimenting in window settings as important parameters of spatial proximity; in particular, I intended to test whether there might be any assumptions, such as the proximity of words being a relevant marker of related meaning. In my research, I have found that window settings are language-specific, so that dealing with Italian early modern texts benefits from wider window settings because of the different linguistic structure than English, the standard target for machine-reading analysis. Keeping those considerations in mind, it was worth trying a wider, and a smaller window to get results at scale, without affecting the collective impact of a specific query. Other technical details to consider are the iterations both in training the model, and in research queries. Every time I repeat the machine reading, one small adjustment helps me to achieve a better picture of the model. Since I have been working with textual sources, there is a constant re-reading of the plain text materials, which in turn resembles humanistic practices of reading one source more than once, in order to understand and study it fully.

In querying the model, within my corpus, validity tests have included the name of cities, names of scientific disciplines, and scientific instruments. Queries have centered around words for "knowledge," "culture," and "ignorance." For my model and, consequently, corpus validation, I needed to test it to see whether that is a useful representation. To validate a model, I can verify whether working with vector math affects my results, for addition, subtraction, and analogies respectively. Negative sampling is another way to reduce distraction noise in the digital process of text analysis. For these reasons, keeping a lab notebook and logbook is an important practice to see and retrace actions, and to develop a dossier narrative later. Using the Word Vector Interface, some searches have shown the following results. Querying "scientia" and "scienza," that is, the word for "knowledge" in Latin and Italian, pulls up results in Latin and Italian respectively. I was looking forward to checking whether any distinction between Latin and Italian could be maintained, which seems to be the case after double-checking a number of concept-words and connectives in those two languages.

Clustering paragraphs with varying windows' dimensions preserves linguistic autonomy, in the instances I have encountered through the Women Writers Vector Toolkit (WWVT). Using the "Operations" function, I could search for "scienza" + "conoscenza" and compare that output to the previous results in which I searched those two main terms for "knowledge" in Italian. Moving further so that I could try an analogy query, I was able to search for "scienza" + "conoscenza," and subtract "bugia" ("falsehood") from that meaning unit. While individual queries have proved useful in framing my questions and finding results, I have found clustering lists to be more contentious to examine, given the random access to paragraphs that is part of the process. Therefore, I have used the value of cosine similarity as a measurement for the nearness among words, through a geometrical measure of the angle between two vectors, with values

ranging between zero and one. Since the use of Latin within an Italian text shows a rhetorical move towards authority and prestige of classical texts, I checked the Latin component (5,524 words ca., 0.5% approximately). The goal is to find ways so that I can work with incomplete data in ways that are not inaccurate or deceptive, or overly simplified. So far, one way to work around similar issues is a methodological shift, thus working with relative magnitude and relative timespans.[379]

Word vectors offer an opportunity to explore the semantic spaces and relationships within a large corpus, discover analogies between words, and study details of register and genre. In fact, literary strategies used in scientific writing reflect not only a paradigm shift in the writer's mindset, but also a shifting appreciation of literature and the contents both on the author's and the readership's side. What makes one's writing authoritative, consequently rendering the author an expert? On the other hand, for parts in Latin, I have also explored how the Italian scientific language derived from Latin and Italian applied to technical fields. Did Latin affect the development of scientific language and the role of translations in the shaping of scientific language? I find this type of text analysis to be effective in the text analysis of Galileo's works, considering the impactful innovation in the Italian language through his works, ranging from Latin (*Sidereus Nuncius*, "The Starry Messenger"), Italian (*Saggiatore*, "The Assayer" and *Dialogo sopra i due massimi sistemi del mondo*, "Discourse Concerning the Two Chief World Systems"),

[379] These findings in quantitative text analysis benefit greatly from the Women Writers Project (WWP) institute "Word Vectors for the Thoughtful Humanist" that I attended at Northeastern University in 2019. The WWP has received a grant from the National Endowment for the Humanities (NEH) Institutes for Advanced Topics in Digital Humanities for a series of advanced seminars on word embedding models and their applications to teaching and research in the humanities. While learning about the Women Writers Vector Toolkit and how the interface allows researchers to conduct word vector analysis on texts already available in the Women Writers Project, the WWP committee encouraged me to build a corpus of texts and experiment with word embedding models via WWP Sandbox folders. The workshop, guidance, and support of Julia Flanders, Sarah Connell, Syd Bauman, Laura Johnson, and Anjelica Oswald have been remarkable. I also extend my gratitude to the Rutgers Digital Humanities Initiative and Lab and the Ms. Elena Petronio Scholarship at Rutgers Department of Italian for support in developing quantitative text analysis on the research corpus of my dissertation. I have published some findings in "Explaining Words, in Nature and Science: Textual Analysis in Galileo's Works", a blog post for Northeastern University Women Writers Project (22 June 2020, https://wwp.northeastern.edu/blog/textual-analysis-galileos-works).

and even the Paduan dialect (*Dialogo de Cecco di Ronchitti da Bruzene in perpuosito de la stella nuova*, "Dialogue of Cecco di Ronchitti from Brugine, on the New Star"). Crystal Hall has demonstrated that reading and writing represent two facets of an author, given that Galileo's persuasion techniques sometimes draw from literary texts such as chivalric epic poems.[380] Furthermore, I would add, Galileo had been quoted in some entries for the academic, standardized Italian language, the *Dizionario della Crusca*. His interest in words was not only in using them for his books, but even in defining their meaning and scopes.

Thanks to cultural parallelisms between humanistic and digital readings of texts, digital humanities methods have yielded results after the foundational work of Father Roberto Busa, who used the corpus of Thomas Aquinas to elaborate a new reading, and searching method in the 1940s.[381] By working with punch-cards and categorizing Aquinas's commentary into those notes, Busa had a digital machine, the personal computer, read those texts through distant readings and statistical observations. Father Busa made the text of Saint Thomas Aquinas' work more accessible to readers, as Aquinas himself had made the philosophical contents in Aristotle's books relatable to Christian beliefs. From such considerations, one level of mathematical knowledge and one level of scientific knowledge coexist in the same texts, not to mention the humanistic and philosophical values defended by the authors I discussed in this chapter. Because numerical values are present and important, alongside rhetorical modes such as emblems and memorable phrases, Arielle Saiber argued that ''information theory'' and the digital humanities are not completely pioneering methods in the humanities, since similar practices would partly derive from Renaissance computing methods. The collaboration of humanistic and technical experts would, then, resemble

[380] As Hall wrote, "As Galileo begins to write and criticize, he also begins to experiment with the literary, not factual potential of the epic poets who might help him to make his case" (43).
[381] See Steven E. Jones. *Roberto Busa, S.J., and the Emergence of Humanities Computing: The Priest and the Punched Cards*. New York: Routledge, 2016.

the work of ‘matematici’ and scholars in the ‘studia humanitatis’ in the Renaissance. In the next chapter, I will investigate how the Book of Nature metaphor and mathematics were applied to medicine, and discuss the ways in which people shared health-related facts, through varying perspectives, in personal and official narratives respectively.

Chapter Four. "Complementing Medical Narratives and Narrative Medicine."

1. Science and Medical Humanities.

One more field of application for the Book of Nature metaphor was medicine, a discipline for which scientific methods and technologies were applied to human health. During the early modern period, medical authors needed to include new epidemic outbreaks in the broader study of nature. Among the medical challenges faced in the sixteenth century were plague outbreaks and a seemingly new disease that caused boils and joint pain, for which even the word had to be found, until physician Girolamo Fracastoro coined the word 'syphilis.' Syphilis became "a symbol of the Renaissance and the model of a sinful and shameful disease," comparable to leprosy and plague in the Middle Ages, as the historian Giorgio Cosmacini has noted.[382] For those new medical cases, new linguistic forms emerged to express technical terms, and medical authors relied on the resulting narrative discourse to express observations and historical considerations, all of which were aspects of medical topics open to discussions in the medical community and beyond.

This chapter, thus, presents literary and historical research on early modern epidemics, their elements, and features. I will discuss literary and visual representations of what it means to be human and healthy, across gender and age divides, in regular or challenging circumstances, epidemic outbreaks included. Since genre and narrative styles are essential elements for this study, a distinction is given for stylistic modes and perspectives regarding medical matters. First, I will consider medical narratives, texts in which authors described their physical and psychological experiences of an illness, in personal letters exchanged between Galileo and his friends and family,

[382] Giorgio Cosmacini, *L'arte lunga*, Roma, Laterza, 2003; 231.

and in autobiographical texts and memoirs, as Cellini and others did. Next, narrative medicine is discussed as the search for a standardized writing style, and one emerging from debates that physicians Fracastoro, Vesalius, Fioravanti, Falloppio, and Massa initiated in the field of anatomy, physiology, and pharmacology.

In addition to medical and personal narrations, the visual arts provide information on early modern views of the human body. As seen in the previous sections of this study, integrating textual and visual sources is fundamental to examine scientific topics as they were presented in books, illustrations, and artworks. Since medical observations are traditionally complemented by illustrations in early modern treatises, a conclusive remark of this chapter sums up a sample of visual representations from the medical and artistic fields. Both scientific illustrations and sculptures reflect anatomical knowledge of that time, through the experiences and collaboration of artists and doctors, and the interconnectedness of their disciplines. People belong to nature, as human beings, and offer new perspectives on nature and human nature, as medical authors perceived us as human microcosms within the natural macrocosm. Through such versatile applications of the concept of the Book of Nature, early modern scholars extended similar observational methods to science and the medical humanities as part of the same knowledge of nature.

2. Medical Narratives: Patients Narrated Plague and Syphilis.

The fact that plague had been an ancient disease did not make it less worrying. The unique perspective of Galileo is here followed to show how subjective experiences and social communication occurred during the plague, discussing such public health concern. Galileo was an uncommon observer of everyday life that he described in letters to scholars, scientists, theologians, as well as friends and family. The historian of medicine Alfonso Corradi suggests that scholars should consider both the emotional experiences of witnesses and, conversely, the detachment of narrators who have not had those experiences.[383] Survivors' medical narratives are first-hand accounts because the authors witnessed and experienced those illnesses, and wrote about them. Additionally, the personal experiences of poet Antonio Cammelli and artist Benvenuto Cellini will be discussed as examples of medical narratives for the case of syphilis.[384]

Many of Galileo's thoughts and experiences during the plague are found in surviving letters that Antonio Favaro collected and edited in the national edition of Galileo's works (volumes X to XVIII). Scholarly attention has not been drawn to the circumstances in which Galileo pursued research, wrote books, and sent and received letters during plague epidemics. Galileo did not stop his scientific research and writing during plague epidemics, and the additional stress for the infection impacted his personal communication with friends and family, as well as the publishing process for his research.

Galileo survived plague outbreaks in the years 1575-1577 and 1629-1631: the latter became the historical setting in Alessandro Manzoni's novel, *I promessi sposi* (*The Betrothed*,

[383] Corradi argued that emotional comments of witnesses and different modes of documentations for those who did not have that experience affect historical accounts of plague years (Corradi 1870, vol. III; 64-65).
[384] This type of source differs from narrative medicine given the degree of formality and professionalization of the authors, as medical narratives are by non-physicians, and texts of narrative medicine are compiled by health practitioners.

1827).[385] Textual and material evidence of Galileo's experience during the plague help me reconstruct the astronomical work of the scientist, as well as his connections to family members, his respect for colleagues, and the warmth of friendships founded on common scientific and humanistic interests and the frequentation of the same social circles in Florence, Padua, Loreto, and Rome. Through an exchange of letters with his correspondents, Galileo could find both unconditional support for his theories and discoveries, and friends to talk to, thus easing the process of coping with illness, at a personal level. What conversations would have captured otherwise, remains through letters in which the personal, social, and intellectual levels of communication all intermingle.[386] Supporters such as Benedetto Castelli, Piero Dini, and Giovanni Ciampoli, for example, would reminisce with Galileo about their previous meetings, with nostalgia and gratitude, and they would look forward to meeting in person again. Other times, correspondents mentioned new remedies that might help to prevent the plague and heal from it, if one contracted it.

During the 1575-1577 plague, Galileo was a boy.[387] During the 1629-1631 epidemic outbreak, Galileo was in his late sixties, busy with research on the tides, mechanics, and astronomy that would be the leading themes of the *Dialogo sopra i due massimi sistemi del mondo* (*Dialogue on the Chief Two World Systems*, 1632). In Florence, the plague started sometime between June and August 1630, and lasted until July 1631, causing 12,000 deaths. There were relapses in July

[385] For details on plagues in the early modern period, see Corradi 1870, vol. II and III. Alfondo Corradi, a physician specialized in pathology and a historian of medicine, listed epidemics across time, considering symptoms and clinical signs (vol. II, 284). Scholars do not exclude that all plague outbreaks in the period 1613-1666 "belonged to one single pandemic cycle which swept across the European subcontinent through an intricate network of channels of infection" (Cipolla 1973, 15). On epidemic outbreaks and social challenges, see Samuel K. Cohn, Jr., *Epidemics: Hate and Compassion from the Plague of Athens to AIDS* (Oxford: Oxford University Press, 2018).

[386] Protective remedies included seclusion and control in lazarettos in peripheral areas, the separation of the healthy from the sick and those people, places, and things suspected to carry plague contagion. There were also attempts to strengthen people's bodies and minds. A general remedy was expurgation with aloe, myrrh, and saffron pills. Keeping clean was fundamental. Other remedies were the Grand Duke's bezoar stone and oil against poisons (Corradi 1870, vol. III, 75-77; 131-132). Giovanni Silvi asked Galileo to send some of the Grand Duke's oil for stomach ailments (21 September 1630; *OG* XIV, 153). A few weeks later, he thanked Galileo for sending that remedy and for the trouble of roadblocks and quarantined items (12 October 1630; *OG* XIV, 154-155).

[387] In Northern Italy, that plague outbreak killed 50,000 people in Venice alone, one third of the total population.

1632 until September 1633, when 1,600 to 1,800 people died.[388] Epidemics were perceived as a matter of personal health, but also one of public health that needed political and social adaptations, such as restriction on traveling, trading, and the circulation of goods, based on regulations that local rulers published. To prevent the spread of plague in Florence, the Grand Duke Ferdinand II had ordered a quarantine on 10 January 1630 that lasted four days longer than expected, to avoid potential gatherings to celebrate the end of carnival.[389]

In Florence struck by the 1630s epidemic, there were health police officers inspecting roads and households, plague patients were moved to appointed areas called lazarettos, and patients' households were under isolation for twenty-two days.[390] There were health commissioners in charge of each neighborhood, and it was mandatory to declare the sick. Plague safety measures in Florence also included constant cleaning of the streets, police checkpoints and military patrols, and the prohibition of trading, apart from local open markets for groceries, at a safe distance. For their purchases, people could drop their coins into a copper pan to be washed in vinegar. Urban quarantines, however, were difficult to implement and enforce, because there was a lack of understanding of their usefulness and public religious rituals were still allowed. While nuns were safe in their convents, friars, instead, were often infected, since they were serving the communities with provisions, charity, and spiritual support. Those who could fled to their second homes in the countryside, and because of this, the Florentine nobility was mostly safe during every outbreak (18 May 1633; *OG* XV, 125-126).

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[388] Corradi 1870, vol. III, 67; 118-133. Investigations on the Florentine plague have been conducted with digital humanities tools in Terpstra and Rose 2016, 132-146.

[389] A way to protect such as the quarantine had also prompted ten storytellers in the *Decameron* to flee Florence, avoid crowds, and stay outdoors. The author of the *Decameron*, Giovanni Boccaccio, wrote short stories to alleviate the recent traumatic experience of the 1348 plague.

[390] Each neighborhood had its own surgeons and pharmacists, with regulated fees. After that first quarantine ended, the Grand Duke and other Medici noblemen walked the streets of Florence to greet and encourage citizens to be optimistic and stay safe (Corradi 1870, vol. III, 124-125 and vol. III, 75-77).

Because of those challenging circumstances, scholars communicated more openly about personal matters, which allows us as modern readers to have an insight into the history of emotions as well as their medical narratives. During the plague, Galileo was ready to publish the *Dialogue* that he had written between 1624 and 1630, and Galileo's correspondents asked for updates on Galileo's everyday life. In 1630, his friend Dino Peri expected that the plague would be a long-time concern, calling that "the year of the plague" ("anno pestilente").[391] Similarly, Paolo Bombini, from Genova, shared fears of infection.[392] From surviving letters and documents, it seemed stressful for Galileo not to know when and under what circumstances and conditions the *Dialogue* could be published, and to see in-person social connections become less frequent. Censorship on printed books acted differently than in normal times, possibly being less rigid, and eventually reinstating solid societal values that were at stake when revolutionary scientific ideas were circulated, through books whose printing and circulation was at elevated risk during the plague outbreak.[393]

Galileo's relatives sent regular letters to him, updating him on plague cases where they resided. Galileo had three children: two daughters, Virginia (suor Maria Celeste) and Livia (suor Arcangela), who were cloistered nuns in the San Matteo convent at Arcetri in the order of the Poor Clares, and one son, Vincenzio. Tender affection united Maria Celeste and her father, who corresponded regularly until her death in 1634 from dysentery.[394] The letters sent by Galileo to his daughter Maria Celeste were all lost, though, or intentionally destroyed by the convent after the

[391] 18 May 1630; *OG* XIV, 100-102.
[392] 30 August 1630; *OG* XIV, 137-139.
[393] Additionally, historical conditions emerge in parallelisms between yesterday's struggles and today's current pandemic, so that Isaac Newton has often been mentioned during the Covid-19 pandemic because of the hardships he faced. In 1666, Newton was self-isolating and social distancing in the English countryside, studying gravity, optics, and calculus in an incredible peak of productivity during the plague.
[394] She addressed her father as "Amatiss.mo Sig.r Padre" and signed her letters as the affectionate daughter "Sua Fig.la Aff.ma Suor M.a Celeste." Though no letters written by Galileo to his daughter Maria Celeste survive, Dava Sobel wrote a fictional account of her life (*Galileo's Daughter*, 1999).

Inquisition trial against her father. In family letters, one finds frequent mentions of acquaintances who were sick, had recovered, or passed away in letters sent to Galileo by Maria Celeste and Geri Bocchineri, who was Vincenzio's brother-in-law.[395] In the first year of the plague, Maria Celeste encouraged her father to be strong and devout. Adversities, she wrote, are a touchstone to prove God's love, and she elaborated on a religious metaphor that shows familiarity with religious texts as well as the experimental practices of science.[396] She also suggested that Galileo should use the same "Lyncean sight" for astronomical observations, as well as for the lowest things on earth, to see the vanity of all mortal endeavors.[397]

Devout Catholics, Galileo included, searched for divine protection against the plague through prayer. Though Galileo ran into conflicts with the Church at least twice, with Roberto Bellarmino's warning issued to him in 1616 and the Inquisition trial he faced in 1633, he talked about his faith and devotion openly.[398] In such general, collective fear, there seemed to be overall confusion among the populace, and physicians themselves invoked the help of God, Mary, Saint Roch, and other saints in medical treatises they wrote. As one doctor said in Venice, honor and praise would be given to divine helpers if everyone involved in the process followed safety and quarantining instructions.[399] Catholic believers invoked God, the Trinity, and saints who protected

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[395] Maria Celeste consoled her father about the sudden death of one of his employees (18 October 1630; *OG* XIV, 155-156) and recommended that he should avoid any risks of contagion with the right preventive remedies ("[…] rimedii e difensivi proportionati alle presenti necessità"). Divine protection and a sincere repentance would calm any anxiety ("[…] la più efficace medicina non solo per l'anima, ma per il corpo ancora"). For example, letters by Bocchineri (16 August 1633; *OG* XV, 226) and by Maria Celeste mentioned recent plague cases (*OG* XIV, 162-164) and ill farmers who were their employees. They also commented that noble families safely fled Florence for the countryside (*OG* XV, 129-130; XV, 146-147).

[396] "So che V. S. sa meglio di me che le tribolazioni sono la pietra del paragone, ove si fa prova della finezza dell'amor di Dio."

[397] "[…] sì come con vista di Linceo ha penetrato i cieli, così, penetrando anco le cose più basse, arrivi a conoscere la vanità e fallacia di tutte queste cose terrene" (2 November 1630; *OG* XIV, 162). The Accademia dei Lincei was founded in 1603 by Federico Cesi. The name of the Academy means 'Academy of Lynxes' because the lynx has sharp vision. Galileo was proud to be nominated as a member of the academy, so he had book frontispieces and his signature as 'lynx eyed'.

[398] On the 1616 warning, see *OG* XV, 170-171.

[399] See *Raccolta di avvertimenti e raccordi per conoscer la peste* (Venice: Ciera, 1630): 27, 63.

against the plague such as Saint Roch, Saint Christopher, Saint Job, and Saint Sebastian. In Venice, there was veneration also for twin brothers Cosmas and Damian, patron saints of medicine and physicians since late antiquity.[400] Throughout Italy, there was also devotion to the Virgin Mary that found expression in a Franciscan prayer and antiphon in Latin, the "Stella Coeli."[401] Devotion to the Virgin Mary was popular also in Loreto, a sanctuary that became more popular during plague outbreaks.[402] There are several references to Galileo's trips to the sanctuary of the Madonna di Loreto where he showed his reverence to the Virgin Mary.[403] In Florence, people hoped for the mediation of Madonna dell'Impruneta and a miracle to bring an end to the plague, and a procession was held in her honor, on 21 May 1633, according to Galileo's daughter and Geri Bocchineri who described the solemn procession that health commissioners had supervised.[404]

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[400] In Venice, there was a church and a *Scuola Grande di San Rocco* (Allen 1902, 107-112), where a religious fraternity and charity guild, founded during the 1478 plague, supported local communities. The *Scuola* expanded and became the wealthiest in Venice. They were able to hire Tintoretto to decorate the new monumental headquarters with a pictorial cycle of Biblical episodes.

[401] Gratitude for the Virgin Mary was particularly evident in Venice where, in 1630, the government issued an order to build a new church, the Basilica di Santa Maria della Salute ('Our Lady of Health'). During the 1575-1577 plague outbreak, Andrea Palladio had been commissioned to build the Chiesa del Redentore. To this day, a procession honors the miracle that saved Venice on the last Saturday of July. The celebration was only suspended in July 2020, to avoid crowds gathering during the Covid-19 pandemic. Through a new monument and renewed charity, the Venetian Republic would ask for divine protection and thank the Virgin Mary for delivering Venice from the plague in which around 94,000 people had died. The plague was over in Venice in November 1631, with 46,000 people dead in Venice and 36,000 in the lagoon (Corradi 1870, vol. III, 102-104). Most of the objects of art in the church have references to the plague. There is a personified Venice praying for health, as well as artworks representing Saint Roch, Saint Sebastian, and saints Cosmas and Damian. The devout visit the Basilica particularly for the Madonna della Salute, a medieval Byzantine icon of Black Madonna (*Mesopanditissa*, Greek for 'the peace go-between') that Doge Francesco Morosini brought back as war booty from Crete, in 1670 (Allen 1902, 104–107). In a visual eloquent testimony from those terrible years, Domenico Tintoretto painted a personification of the city of Venice that supplicates the Virgin Mary to intercede with Jesus for the cessation of the plague. Tintoretto's oil painting (1630-1631) was recently displayed at the art exhibition "States of Health: Visualizing Illness and Healing," curated by Veronica White at Princeton University Art Museum (2 November 2019 – 2 February 2020). On the Franciscan prayer, see the recent article by Santorelli.

[402] On the sanctuary of Loreto, see Bartoli 1761, 73; Moroni 1879, 240; 480.

[403] References to Loreto are cursory in the extant letters, without much comment, because it was a well-known locale among Galileo's correspondents. For example, the Polish knight Christopher, Duke of Zbaraz (27 September 1612, *OG* XI, 399) informed Galileo he was staying in Loreto for a week. Galileo wrote from Rome to the Medici State Secretary Curzio Picchena to ask for permission from his rulers to visit Loreto (13 February 1616, *OG* XII, 233-235). The Medici rulers seemed aware of Galileo's devotion for the Sanctuary of Loreto, as Cosimo II wrote a letter to introduce Galileo in Urbino to Duke Francesco Maria della Rovere (23 May 1618; *OG* XII, 392-393). Years later, Giovanni Battista Rinuccini, Archbishop of Fermo, and Monsignor Piero Dini expressed that they would have liked to have met with Galileo in Fermo, had they known he was on the way to Loreto.

[404] See letters written on 14 May 1633; *OG* XV, 118-120; 12 May 1633, *OG* XV, 127.

A friend of Galileo, Guiducci, wrote there was immense hope in such a miraculous image.[405] Guiducci was one of the four patricians in charge of administering special provisions to the Santa Maria Novella neighborhood, and at the end of such public health crisis he wrote a panegyric to the Grand Duke for the urban preventive plans he enacted at the end of 1630.[406] Guiducci believed that the plague had started declining "in quality and quantity" after the procession of Madonna dell'Impruneta (28 May 1633; *OG* XV, 138-140). [407] He was looking forward to meeting Galileo, as he wrote that it felt such a long time until Galileo would be safe. He insisted on showing his optimism, while being aware that some believed Galileo's book (the *Dialogue*) would be forbidden for scientific, political and moral reasons, but he argued that everything would be bearable, if Galileo returned home safe and healthy.[408] Galileo corresponded with another Florentine health commissioner, Niccolò Cini, who was happy to hear good news from Galileo, compensating for his harsh daily tasks related to the plague (21 May 1633, *OG* XV, 129).

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[405] Guiducci had been the front man for the publication of Galileo's book *Discourse on Comets* (1619). He wrote: "La speranza che si ha in questa sempre, a benefizio della città, miracolosissima imagine, è grandissima, et il popolo ha concepito grandissima speranza di rimaner libero, mediante l'intercessione della Santissima Vergine" (21 May 1633; *OG* XV, 130-131). On that same day, Maria Celeste wrote to her father as she was worried about his journey back to Florence and she only hoped for help from the Virgin Mary, traveling in procession from Impruneta to Florence (*OG* XV, 129-130). A few days later, Andrea Cioli wrote to the Florentine ambassador, informing him that their prayers had been answered ("grazia", 26 May 1633; *OG* XV, 134) and there was talk of a Jubilee celebration.

[406] *Un panegirico a Ferdinando II Granduca di Toscana per la liberazione di Firenze dalla peste*, Florence: Landini, 1634. The book, however, was printed four years later, in 1634, when dangers of the plague seemed to have lessened, with fewer concerns to spread epidemics by handling printed books. Guiducci had been very cautious in his role as health commissioner, since the circumstances were neither improving nor worsening, in an alternation of good and bad days ("ne' travagli di questa città … io non mi avventuro punto in risico alcuno più di qualsivoglia che rigorosamente si guardi, perchè la carità non soprabbonda tanto in me che mi esponga a pericolo niuno; oltre che la cura che io ho non lo richiede punto" 14 May 1633; *OG* XV, 120-121).

[407] From Saturday to Monday, the statue visited several urban areas, stopped in Arcetri, and returned to Impruneta. There were decorations, lights, and fountains by Galileo's house, as Maria Tedaldi, a friend, commented (28 May 1633; *OG* XV, 138-140). Maria Celeste wrote to her father that health commissioners ("SS.ri della Sanità") had requested several convents, including hers, to have two nuns, day and night, pray for the end of the plague (18 June 1633; *OG* XV, 156-158). On 4 June 1633 (*OG* XV, 146-147), Maria Celeste had reported no deaths and fewer cases in town, but also concerns for increased contagion because the weather was warmer. She also informed her father about the visit of Madonna dell'Impruneta in their church. To allow the statue of over seven hundred pounds into the church in Arcetri, they had to tear down the wall of the courtyard and raise the church door.

[408] "[…] mi par un'hora mill'anni di vederla fuora di questi viluppi" (28 May 1633; *OG* XV, 136-137).

When plague was devastating Italy, people were homebound with urban lockdown, the closing of schools and universities, and limited access to outdoor activities except for grocery shopping. Books, then, compensated for limited personal interactions. There might have been some comfort, for Galileo's readers that the *Dialogue* is presented as a conversation among three friends at a Venetian palace, in four consecutive days of conversation. Throughout that book, readers could meet, at least fictionally, the Florentine Filippo Salviati, who voiced Galileo's Copernican ideas, but also the Venetian aristocratic Giovanfrancesco Sagredo, a supporter of scientific methods, and Simplicio, an Aristotelian professor. For Galileo, writing the *Dialogue* was also an opportunity to reminisce about his now deceased friends Salviati and Sagredo, who inspired the namesake characters, and their cultural meetings at Casa Morosini in Venice.[409]

While isolated safely at home, Galileo could count on his books to retrieve information on scientific topics, and for entertainment. From studies on Galileo's library, it is known that he had an extensive collection of over five hundred and eighty books that have been studied by Favaro and, more recently, by Camerota, and by Hall who reconstructed his library.[410] Several of his books were on medicine, which should not surprise us because Galileo had originally enrolled at the University of Pisa as a student of medicine, following his father's projected ambitions for him. When Galileo changed his mind and shifted his interests to mathematics, physics, and astronomy, he remained curious about scientific, humanistic, and theological disciplines alike. Furthermore, Galileo's health had often been poor, and Favaro suggested that Galileo might have had

[409] See Corradi 1870, vol. III, 108-110. In a letter by Liceti (6 June 1636; *OG* XVI, 434-35), it is discussed that Galileo had stopped looking at the night sky because of health problems. Some years later, in 1640, Galileo, lonely and blind, would recall his time working at the service of the Republic of Venice as a professor at the University of Padua (1592-1610). Those were the eighteen happiest years of all his life, as he wrote to his friend Fortunio Liceti (23 June 1640; *OG* XVIII, 209). The population of Padua also suffered greatly during the plague, its university was closed during the epidemic, and two friends of Galileo's passed away, Professor Cesare Cremonini and the historian and antiquarian Lorenzo Pignoria.

[410] See Favaro 1889; Camerota 2010; Hall 2015.

hypochondriac tendencies.[411] There were also contemporary medical books: a medical treatise (*Sermo de causis atque natura pestis et cura*, 1610) written and donated to him by his former student Ottavio Brenzoni (3 April 1610, *OG* X, 309-310); a popular book about pharmacology by Leonardo Fioravanti (*Del compendio dei secreti rationali*, 1581), and a book on diet and weight by the medical professor Santorio Santorio, a friend of Galileo's (*Ars ... de statica medicina*, 1614).[412]

A less conventional book on medicine that Galileo owned was a collection of poems by literary author and physician Giraldi Cinthio, including an educational poem on the human body where Cinthio explains the function of each body part (*Poematia*, 1544).[413] Galileo also owned two classical medical works by Galen, in the Latin translation (*De pulsibus*, 1538 and *Omnia quae extant*, 1556), and one commentary by Vincenzo Mondino (*Expositio in Galeni lib. Artis medicinalis*, 1586). He also had books on herbal medicine: a book by Joseph Du Chesne (*La ricchezza della riformata farmacopea overo Antidotario riformato*, 1619), one by Konrad Gesner (*Historia plantarum et vires*, 1541), and one by Garcia de Orta (*Dell'istoria de' semplici aromati et altre cose che vengono dall'Indie orientali*, 1597), as well as the Italian translation of Pliny the Elder's *Naturalis Historia*, a reference book and encyclopedic collection on a variety of disciplines, including botany and medicine. In Galileo's home library, there were also self-help books containing general advice on diet and nutrition: one book by Domenico Romoli (*La*

[411] Favaro referred to the correspondence between Galileo and his physician and friend, the famous professor of medicine Fabricius ab Aquapendente ("[…] dall'Acquapendente è ben noto che Galileo si faceva curare nelle troppo frequenti malattie," Favaro, *Galileo Galilei e lo Studio di Padova* 36).

[412] Galileo had several friends in Venice, some of whom bought lenses in Murano for him, so he would not have had difficulties commissioning purchases, while pharmaceutical compounds that Fioravanti had invented were on sale at local Venetian pharmacies. Santorio sent a letter to present his book to Galileo, emphasizing the numerous case studies he had studied, Galileo being one of them (9 February 1615; *OG* XII, 140-142).

[413] *De usu partium sive de partibus corporis humani carmen*. See Renato Ricco, "Per l'edizione critica del carme *De usu partium corporis humani* di Giovan Battista Giraldi Cinzio." *Studi giraldiani* I (2015): 61-67. The printed version does not include the entire poem, which is complete in the manuscript version found in Ferrara, Biblioteca Comunale Ariostea, ms. Classe I 370.

singolare dottrina di M. Domenico Romoli… dell'ufficio dello scalco… un breve trattato del reggimento della sanità, 1560) and one by Baldassarre Pisanelli (*Trattato della natura de' cibi et del bere*, 1587).

3. Galileo and the Plague.

As mentioned earlier, Galileo survived two plague outbreaks, in 1575-1577 and 1629-1631. Such experiences with the plague emerged both in first-hand accounts, through letters exchanged with family and friends, and in references in his books. For example, Galileo was proud of defending truth and objectivity as opposed to worthless topics, and he mentioned that contrast in a satirical poem by Francesco Berni. While the poet had praised something bleak such as the plague, Galileo believed that stylistic choice, instead, to be a disgrace and completely inappropriate for literary treatment (*OG* IV, 446).[414] Berni had argued that plague was a test of everyone's connections, and out of metaphor, it seemed to affect human bonds so that it would show only one, out of one hundred former friends, to be still there for you.[415]

Such challenging circumstances and limited interactions seemed to put a strain on family bonds, as Galileo learned while living during the plague. For example, his son Vincenzio fled Florence to escape the plague with his wife Sestilia to go to Montemurlo, a town near Prato, but he left his son behind, so that Galileo had to look after his namesake grandson ("Galileo piccino").[416] In another letter, we learn that Galileo's daughter Maria Celeste remarked that health is genuinely appreciated as a gift during adversities. Though Vincenzio often asked for money to his father, Maria Celeste hoped her brother would not request more, because plague suspicions encouraged people not to exchange money and, when they did, it needed to be handled through pans and vinegar, as mentioned earlier. That summer, she missed her father very much, and was hopeful that they could meet again soon.[417] Maria Celeste did her best to take care of her father's

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[414] Francesco Berni, ed. Danilo Romei. *Rime*. Milano: Mursia, 1985.
[415] "La peste è una prova uno scandaglio, / Che fa tornar gli amici a un per cento" from the poem "Capitolo secondo della peste" (lines 98-99).
[416] 12 March 1631; *OG* XIV, 221-222.
[417] "[…] se bene, quando si ha la sanità, l'altre cose si tolerano facilmente . . . Ci lamentiamo del tempo, invidioso del gusto che noi, insieme con V. S., in questo giorno havremmo potuto prendere con ritrovarci in compagnia" (27 August 1631; *OG* XIV, 290-291).

health, both physical and emotional. She wrote regularly, prayed for him, and sent food and medications to protect him against the plague, which according to the current medical terminology were considered "protective remedies" (2 November 1630; *OG* XIV, 162-164).[418]

In November 1630, Maria Celeste sent a letter and two protective remedies mixed with honey. An electuary ("lattovaro," a lexical variant for "elettuario") was a remedy where a powder, or another ingredient, was mixed with an ingredient such as honey to make it sweet, thus easier to eat. That time, Maria Celeste distinguished between the two remedies she sent, by using a label on one of them only. So, the remedy with the label was the one with honey, as was common for a so-called electuary, and dried figs, walnuts, rue, and salt. That remedy would be most effective when eaten in a small amount, the size of a walnut, every morning before breakfast, to be followed by a small amount of Greek or some other good wine to drink immediately after. The remedy she had marked with a label might have tasted less sweet than the one containing honey, but she promised that she could improve the recipes, if her father wanted to have more of either remedy.

Though a cloistered nun, Maria Celeste served as a liaison between Galileo and neighbors, friends, and colleagues of her father, and her siblings, suor Arcangela and Vincenzio. She also showed some awareness about travel safety, as she recommended her father to delay his journey back from Rome, suggesting a stop in Loreto when there started a plague relapse in Florence in the forthcoming summer. She hoped he would be back in time to pick fava beans and some lemons in the Arcetri house (16 April 1633; *OG* XV, 89-90). There were contrasting opinions on when it was safe to travel, as we see in letters by Maria Celeste, by Geri Bocchineri, and by the health commissioner Mario Guiducci, in the spring and summer of 1633. In addition to plague concerns and increased safety restrictions to travel, the Inquisition trial greatly distressed Galileo.

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[418] For a sample of preservative remedies, see Piero Antonio Fortunati, *Thesoro preservativo contro la peste*. Pistoia, 1630.

During the Inquisition trial, friends and family sent warm thoughts and their support to Galileo, oftentimes very subtly, without mentioning those extenuating circumstances in which Galileo found himself forced to go to Rome. Maria Celeste was happy to hear, from two of her father's letters, that he was doing well considering the circumstances, as this was during his Inquisition trial. Maria Celeste seemed concerned because she had suggested on 30 April 1633 that the contagion was about to end soon, thus encouraging her father's journey back to Tuscany, but by June it was clear that additional caution was needed.[419] On 11 June 1633, Bocchineri considered it safe enough for Galileo to travel back, if he traveled before St. John's day (24 June), and if he stopped in Siena, he could wait for cases to decline in Florence. Maria Celeste also wrote on that day and agreed that her father should be careful and stay in Siena, in the hope that warmer weather would keep the epidemic away, and it is known from details in Maria Celeste's letters that a common messenger would often collect letters from her and Bocchineri and send those to Galileo jointly.[420] From a letter by Geri Bocchineri, Galileo learned that the Grand Duke had requested a pardon for Galileo from the Pope, and it would be safe to travel back to Tuscany once roadblocks and health officers and commissioners had been removed, even though just one day earlier there had been one person reported to have the plague. Guiducci informed Galileo that it was safe to return to Florence anytime he had permission from Rome, as fifty days had gone by without any health commissioners or their staff dying.[421] To Galileo and his numerous friends, Guiducci wrote, it felt like "one thousand years" without seeing Galileo ("Mi par mill'anni che V. S. sia libera, et il medesimo desiderio tengono tutti gli amici, che ella ci ha in gran numero").[422]

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[419] *OG* XV, 108-109.
[420] *OG* XV, 152.
[421] 13 August 1633; *OG* XV, 223.
[422] Missing friends and family seemed to be a common experience and a wish for many people in quarantine. As Maria Tedaldi put it, their friend Lucrezia had everything she could wish for, a beautiful house, a loving husband, and a newborn baby, but she could not see her family (28 May 1633; *OG* XV, 138-140). For a private account of Galileo's personality, wits, and versatility, see Shea 2019.

Additional quarantines, however, were implemented during a relapse of the plague in Florence at the end of April 1633, when there were higher rates of infection. Florentine decrees were published to forbid women and children younger than fifteen from going out for ten days, unless in a carriage. In Florence, only the produce market in Santa Maria Novella would be open.[423] These new circumstances worried Maria Tedaldi who was one of Galileo's few female correspondents. Maria seemed concerned during that third year of plague which brought greater suffering and fatalities, so that women and children would be quarantined, starting on Sunday, 24 April 1633. When the quarantine for women and children was extended, Maria asked for Galileo's mediation to obtain a special absolution from the Pope in Rome, in case she and her devout sister died.[424] At the end of that additional quarantine, however, Bocchineri wrote that there were fewer cases and deaths, while people in the lazaretto sometimes seemed to recover.[425] It was, then, decided to have a public religious procession in honor of the Madonna dell'Impruneta, and more processions, too. About two weeks later, Bocchineri's family would wait for the end of the plague in Siena for a week, when it was hoped to have the miraculous intercession of the procession. When the statue of Madonna dell'Impruneta had passed by Galileo's house, Bocchineri's family made special effects with a fountain, admired as the most beautiful ones in the procession, and considered to be ingenious special effects designed by Galileo.[426] Then, there was an unexpected plague relapse in the spring and summer of 1633, which was highly contagious and alarming.[427]

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[423] 23 April 1633; *OG* XV, 102.
[424] 14 May 1633; *OG* XV, 117-118; 122-123.
[425] 18 May 1633; *OG* XV, 125-27.
[426] Geri Bocchineri referred to those special effects as "your secret doing" ("un segreto di V. S." 26 May 1633; *OG* XV, 132-33).
[427] One very reserved neighbor and two friars died, but very few patients resided in the lazaretto (20 August 1633; *OG* XV, 230-31). Maria Celeste, living in a convent, was careful to check the social habits of those she would interact with, noting that her helper Piera would only go to the convent and to church, while the errand boy only went out to collect the mail.

While Galileo's family, friends, and colleagues worried about his safety, seclusion, and scientific work, others attempted to avoid recommendations and orders altogether. Galileo believed that someone would worry less for a universal contagion than for a personal health problem. Furthermore, to those people in denial of an epidemic, knowledge itself might feel like plague itself to be dangerous and threatening, according to Galileo.[428] While some people were in denial of the epidemic, others advanced conspiracy theories.[429] In Milan and Turin, there were suspicions of plague-spreaders ('untori') during the 1576 and 1599 plague outbreaks, and by 1629, the belief in plague-spreaders was virtually unanimous in Milan. Notwithstanding collective fears, there was no such belief in the Republic of Venice, Emilia, and Tuscany, as Corradi noted.[430] Historian Carlo Ginzburg argued that such search for a scapegoat was a way to dispel fears, tensions, and the shock of experiencing epidemics (Ginzburg 63-68), and Samuel K. Cohn Jr. has agreed on those perspectives (Cohn 271).[431]

Because of the initial resistance against urban lockdowns, sixteenth-century physicians Andrea Gratiolo, Niccolò Massa, and Girolamo Fracastoro had insisted that physicians needed to become experts in matters of plague, so that charlatans could not operate, just as had been the case

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[428] *OG* IV, 444-45. Other metaphorical references to the plague were present in a letter sent by Malatesta Porta. Malatesta, a poet from Rimini, had also included a poem he wrote and dedicated to Galileo (13 September 1616; *OG* XII, 279-283). Porta's praise for Galileo concentrates on key values, such as the Accademia dei Lincei and the telescope: "Finché LINCEO mirar verrà, che scopra / Quelle, ch'ignote son, forme là sopra. / Tu, GALILEO … Saprai con l'arti tue vincer Natura" (lines 15-17; 20-24). The poet Porta also denied any astrological influence in diseases, so that Saturn is a planet with three bodies like the mythical creature Gerion, not a cause for "famine, plague, and sorrow" (line 8). The capitalized words 'Linceo' and 'Galileo' were marked uppercase in the original text, for emphasis.

[429] At the beginning of the epidemic outbreak, in Milan and elsewhere, communities went through a phase of denial and used lexical circumlocutions to discuss the public health situation. As Corradi explained, people claimed it was not plague and it was forbidden to mention plague, instead, they referred to pestilential fevers. Later, the disease would be acknowledged as plague, but not the traditional one, so that they would call it plague, in lack of better words. Finally, it would be called plague without any doubts (Corradi 1870, vol. III, 69-70). After initial resistance, though, only few people had trouble admitting that it was a contagious disease, unlike previous plague outbreaks.

[430] Corradi 1870, vol. III, 70-71.

[431] According to Ginzburg, conflicts would arise because there was no remedy, nor an understanding of the origins of the plague (Carlo Ginzburg, *Ecstasies: Deciphering the Witches Sabbath*, 2004 [1989], 2012, 11; 165).

with the early years of the syphilis epidemic.[432] The fact that they were experienced in epidemics of plague and syphilis enhanced the credibility and the authority of their medical statements, corroborated by historical understandings of previous epidemic outbreaks. In 1630, the Venetian government consulted doctors who had experienced the 1576 plague, including Santorio Santorio, who recommended the highest caution in matters of public health, so that it would be safest to treat the new epidemic as if it were plague, before ascertaining its nature, to be safe.[433] Medicine could benefit from medical history, so that common signs would encourage similar actions and treatment, which is one of the most impactful effects of the Book of Nature metaphor, as the study of nature acquired a historical dimension to it, through the study of medical cases across time.

Quarantine had not hindered Galileo's scientific work, but it had delayed the publication of one of his books, the *Dialogue* that he eventually was able to publish in 1632, and those historical circumstances affected the reception of his scientific work. Scholars became isolated, yet they stayed connected thanks to correspondence, but letters were carried with additional care and took longer to get delivered. One of Galileo's correspondents, the mathematician Bonaventura Cavalieri wrote from Bologna, relieved to know that Galileo was fine even though he had been in areas of high plague incidence.[434] Cavalieri taught at the University of Bologna, which was shut down during the plague, even though very few people were at the lazaretto. Without any certainty regarding university stipends, Cavalieri was trying to publish more of his work, so that he could demonstrate that he was productive and ready to be on the job market, if needed.[435] In concluding

[432] I have showcased a timeline of the main textual and visual sources of syphilis outbreaks in the sixteenth century: "A Sourcebook of Early Modern Medicine" (https://sourcebookmedicalhumanitiesscience.wordpress.com).
[433] Corradi 1870, vol. II, 70; 101-107.
[434] 3 December 1630; *OG* XIV, 170-71.
[435] It was difficult to find jobs during the plague, as Maria Tedaldi reported to Galileo. His son Vincenzio was unemployed. That year, the plague was different: only one lazaretto was enough to handle those who were sick, but there was a high mortality rate. Four of Galileo's neighbors died, as well as the young Portuguese physician's son, a physician himself (14 May 1633; *OG* XV, 122-123).

his letter, Cavalieri renewed his esteem and affection for Galileo from afar, because at that time it was not possible to show his reverence in person, but he was looking forward to the publication of the *Dialogo* and the progress of Galileo's book on motion, *Discorsi e dimostrazioni matematiche intorno a due nuove scienze* which we know would eventually be published by the Elzevirs in Leyden in 1638.[436]

Travel was restricted for people as well as goods, food items, and wine. Fumigation was practiced on all items traveling from areas stricken by the plague, books included. Even letters required some caution in handling, and correspondence was sometimes fumigated or left outside for some time to avoid any risks of contagion. Book covers and their bindings would be burned, as would anything suspect of contagion. To protect Galileo's books from material damages, Florentine ambassador Francesco Niccolini wrote to the Medici Secretary of State, Andrea Cioli (28 March 1632, *OG* XIV, 339), suggesting that Galileo should postpone shipping his printed books to the Roman Inquisition until May, because books released from lazarettos would be unbound and dosed with perfumes. Sometimes libraries would be distributed to interested readers, in an attempt to save them, as seen in Galileo's *Dialogo* ("Terza giornata"), where Salviati suggested that he only had a chance to learn about the book on magnetism by Gilbert because he received it from an Aristotelian philosopher who wanted to protect his own library from contagion.[437] The previous owner of Gilbert's book, however, might have meant to insult philosophical opponents, as he was afraid that the English scientist's ideas could infect his

[436] Galileo was worried about the situation in Bologna, because a friar had died of plague in Cavalieri's monastery and Cavalieri reassured him that the situation was improving and the lazaretto officers had left the convent (24 May 1631; *OG* XIV, 265-266; 10 June 1631; *OG* XIV, 275).
[437] *OG* VII, 426. The book on magnetism is William Gilbert's *De magnete* (London: Peter Short, 1600).

Aristotelian library, as much as the plague or plague fumigations could damage his own material collections of books.[438]

More information about Galileo is available, though indirectly, from people writing to him, or writing to others about him from abroad during the 1629-1631 epidemics. Elias Diodati, one of Galileo's strongest supporters outside of Italy, wrote from Geneva to the German polymath Wilhelm Schickard in Tubingen to express concern for the ongoing plague outbreak in Tuscany and the terrible situation in Italy during plague, war, and famine.[439] Among Galileo's international correspondents, there was concern and anxiety during the Inquisition trial, concurrent with the plague epidemics, and afterwards, as Pierre Gassendi wrote from Marseille that he was happy to know Galileo was recovering, and planned to visit him in Arcetri.[440] Ismael Boulliau wrote from Paris that he had decided to contact Galileo in Florence as soon as possible, after hearing from a friend that Galileo had recovered his health in such difficult times of war and dangers.[441] Hugo Grotius, living in Paris, urged Gerardus Vossius in Amsterdam to communicate with Galileo, who was ill.[442] In a letter to Caspar Hofmann, a physician in Altorf, Matthias Bernegger, a philologist, apologized for not reorganizing Galileo's letters yet.[443] Bernegger, who translated the *Dialogo* into Latin, was certain that Galileo was alive, living in Arcetri, near Florence.[444] Elias Diodati, who had persuaded Bernegger to translate the *Dialogo*, had told him that Galileo was almost blind, but healthy, and had sent his favorite book (possibly *Discorsi e dimostrazioni matematiche intorno a due nuove scienze*, 1638) to be published by the Elzevir printing press at Leyden.

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[438] Book production and circulation, but also library maintenance were affected by the plague. At times, library dispersal was seen as a form of protection.
[439] 11 February 1631; *OG* XVIII, 428, and 11 May 1631; *OG* XVIII, 429.
[440] 13 October 1637; *OG* XVII, 197.
[441] 30 October 1637; *OG* XVII, 207.
[442] 28 May 1638; *OG* XVII, 335.
[443] 20 March 1639; *OG* XVIII, 31-32.
[444] *OG* XVII, 365.

In Italy, Galileo's friends were struggling under the new circumstances and the caution one needed to avoid the plague. A professor of mathematics at Pisa and former student of Galileo's, Niccolò Aggiunti, had moved back with his father in Florence, after the university closed in Pisa and any hope of salary raises in Pisa had vanished.[445] He complained about being back home, because his father controlled what he ate, possibly because it was thought that a special diet would protect against contagion, and Aggiunti insinuated, ironically, that his father would rather have him die hungry, than sick with the plague. Furthermore, as a safety measure, professors needed to quarantine before entering the city of Pisa again. Aggiunti, though, would wait for an official convocation from the university before traveling, given the increasing cases of plague-related symptoms such as carbuncles and swellings.[446]

The social circumstances during the plague posed challenges to Galileo's health and affected his scientific work as a scholar and consultant. In addition to his scientific research, Galileo was an advisory member of one engineering committee to study the Bisenzio river on behalf of the Medici family, following the Grand Duke's decree (20 December 1630). Galileo recommended postponing hydraulic engineering on the river which flows into the Arno at Signa because project managers and workers would need to cross areas with a high incidence of plague, and to stay in areas equally dangerous for those reasons.[447] Furthermore, conflicts with the Church and the Inquisition trial took place during the plague. In his scientific agenda, Galileo wanted approval for his *Dialogue* from the Pope. While his Inquisition trial is widely known, it has been understudied whether the book shipping and theoretical negotiations have impacted the *Dialogue*

[445] Aggiunti had become a professor of mathematics at the University of Pisa in 1626. Galileo had recommended Aggiunti for that job after Father Benedetto Castelli, also a former student, had retired.
[446] Aggiunti told Galileo he would feel safer and quarantine before re-entering Pisa ("[…] far un poco di contumacia" (28 October 1630; *OG* XIV, 160-161).
[447] *OG* VI, 615-18; *Scritture attinenti all'idraulica* 653.

that Galileo completed and sent to the Roman censor in 1630. Galileo's correspondence exchanged with his supporters shows how they worked around quarantines and travel restrictions for books and people, because Galileo still hoped that the *Dialogue* would be published in Rome with the patronage of the founder of the Lyncean academy, Prince Federico Cesi, who had sponsored the publication of *The Assayer* in 1623.[448]

In 1630, Galileo decided to go to Rome to obtain the ecclesiastical permission or 'imprimatur' which was required by censors in post-Tridentine Italy. Because of travel restrictions, a sort of passport or travel visa was required to ensure that a traveler had been checked and quarantined properly. Galileo went to Rome six times in his lifetime, every time with the purpose of meeting high-ranking cardinals, humanists, and scientists, to promote his books and theories in the right cultural establishments, as William R. Shea and Mariano Artigas have shown (Shea and Artigas 2005: 5-25).[449] Several political concerns troubled the Pontiff in 1630. The Thirty Years' War had begun as a religious conflict between German Catholic and Protestant princes and had come to involve other motives and more countries, including Italy. Furthermore, Austrian Habsburg troops crossed the Alps during the war of the Mantuan Succession and left the plague in 1629. The epidemic disease spread quickly afterwards.[450] Though Galileo was travelling officially,

[448] Prince Cesi died in August 1630 (*OG* XIV, 137-139; 292-293).

[449] During his first visit in 1587, Galileo went to Rome to network and get good references from leading Jesuit scholar Christopher Clavius. In 1611, he visited Rome to validate his discoveries with the telescope. During that visit, he also met Cardinal Maffeo Barberini, who later became Pope Urban VIII, some Jesuit scholars, and Prince Federico Cesi. From 1615 to 1616, he was in Rome to promote Copernican theories. In the summer of 1624, he went to ascertain whether he could write a book on the motion of the Earth. During that stay, Galileo had been able to meet the new pope, Urban VIII, six times in seven weeks. It was after that trip that Galileo thought he was allowed to write a book on the hypothetical motion of the Earth, as long as he avoided any statements about that motion being physically true.

[450] The 1630-1631 plague started in the state of Milan and in Piedmont. In those years, the population was struggling with malnourishment (Corradi 1870, vol. III, 63-138). In 1628-1629, those areas were stricken by typhus and hemorrhagic fevers and there was a severe famine in Northern Italy. At Padua University, anatomical dissections were carried out on those deceased who were suspected to have plague (Corradi 1870, vol. III, 56-63). Given the wide circulation of the epidemic in the Italian territories, there was soon an understanding that the disease was the same everywhere and that it was contagious (Corradi 1870, vol. III, 67). As Cipolla stated, 'Italian rarely agree on anything, but in this instance, once the plague had been recognized as such, almost everybody agreed that it had been brought into Italy by the German soldiery' (Cipolla 1973, 16).

he did not follow proper diplomatic procedure. Hence, the Florentine ambassador was surprised when he received him on 3 May. Galileo probably met the Pope on 18 May 1630, the same day on which the *Avvisi* circulated in Rome, with rumors insinuating that Galileo was trying to publish a book and attack many opinions defended by the Jesuits, and that he had also predicted that the Pope and his nephew Taddeo Barberini would die shortly after June 1633.[451] These rumors might have exacerbated the Pope's resentment against Galileo, whom he had considered a friend and addressed as a brother in some letters, not to mention a Latin celebratory poem, *Adulatio perniciosa*, that he had written as a cardinal in honor of Galileo.[452]

Those contrasts, negotiations, and resolutions were communicated by letters, until Galileo made it to Rome when he was summoned for the Inquisition trial. He resisted the idea of sending the whole *Dialogue* to Rome because communications between Florence and Rome were interrupted during a plague outbreak. Thus, Galileo requested the censoring take place in Florence. For this to happen, Galileo's friend Caterina Riccardi Niccolini, the wife of the Florentine ambassador in Rome, persuaded her brother Niccolò Riccardi, the Dominican friar who was Master of the Holy Palace, or Roman censor, to view only a sample of the book at the beginning, and the ending.[453] Father Riccardi followed his sister's advice and transferred the censorship to his colleagues in Florence, so he forwarded his comments and criticisms on the *Dialogue*. To mitigate controversies over astronomical positions and speed up the publication approval, Galileo wrote an

[451] Reports are found, titled *Avvisi di Roma*, a sort of early modern newspaper publication (*OG* XIV, 103). Galileo occasionally used to cast horoscopes upon request, as it was a lucrative business for mathematicians at that time.
[452] In that poem and in some letters, Barberini referred to Galileo in affectionate, brotherly terms ("come fratello"; 28 August 1620; *OG* XIII, 49). While he was a Cardinal, Barberini had praised Galileo and his work, and had written a poem in Latin about it ("Adulatio perniciosa," *Maphaei S. R. E. Card. Barberini, nunc Urbani Poemata*. Paris: Antonio Stefano, 1620: 46-49). Barberini praised Galileo's discoveries. Barberini's poems had a great number of subsequent editions and reprints, however, the poem dedicated to Galileo was always kept and printed as part of the collection. See Shea and Artigas (2005): 145-150, 197.
[453] Caterina Riccardi Niccolini became a close friend of Galileo's, and nine letters survive of their correspondence in between 1630 and 1634.

additional section, a preface in which he declared that all statements were presented hypothetically in the book. By doing so, the *Dialogue* was quickly approved by the censors in Florence, where the book was printed by Giovanni Battista Landini in 1632. On 22 February 1632, there was a meeting at the Pitti Palace to celebrate Galileo's *Dialogue*, and the Grand Duke of Tuscany received officially a copy of the newly published book. The book was to be sent to Rome soon after, but mail was delayed because of restrictions on travel and the transportation of goods that each area implemented during the plague, to protect and safeguard public health. Though regular mail between Florence and Rome would have taken only a few days, travel restrictions caused considerable delays during the plague outbreak, so that only two copies of the *Dialogue* made it to Rome by June, and six more copies arrived in July. Pope Urban VIII and the Jesuits saw Galileo's book and expressed their disapproval and anger at seeing what they considered to be liberties that Galileo had taken in times of plague. In July 1632, the Pope ordered the removal of the *Dialogue* from bookstores, and the book was banned. Galileo was summoned to Rome to testify before the Roman Inquisition in September 1632. That month, the Florentine ambassador had a meeting with the Pope and tried to learn what the charges were against Galileo, in deference to the Grand Duke to whom the book had been dedicated, and for whom Galileo worked.

The Pope, however, refused any extrajudicial treatment. Galileo was summoned to Rome on 1 October 1632. He tried to earn some time and wrote to Cardinal Francesco Barberini, whom he had tutored in mathematics, on 13 October. Galileo asked Cardinal Francesco Barberini, the Pope's nephew and an inquisitor, for clemency considering his age of seventy.[454] Galileo explained that he was not healthy, the roads were rough, and the weather was getting worse that time of the

[454] Galileo, however, was born in 1564, so he was sixty-eight years old at the time. He might have lied about his real age because people past seventy could not be tortured, based on Biblical laws. Cardinal Francesco Barberini would later defend Galileo, trying to persuade his uncle the Pope, that Galileo had no intention to offend him (*OG* XVI, 363; 449-450; 455).

year, so he would not be able to get even halfway to Rome. Therefore, he asked to transfer the procedure in writing, or in person in Florence, before the local inquisitor, while restating his willingness to submit to the will of the Roman Inquisition. The Roman Inquisition repeated their injunction that Galileo should travel to Rome, or he would be arrested and brought there in chains.[455] The combined stress of the plague and the Inquisition trial shows in letters from Galileo's family, who "tracked the progress of the plague outbreak as they tracked his trip back home to a life of imprisonment" (Marcus 2020). At the Roman Inquisition, another reason of concern was the fact that the *Dialogue* had been published, sold, and circulated across Europe, though a few copies had been lost and quarantined at country borders.[456] Galileo's friends were busy protecting his reputation and safety, for example Magalotti had to answer Father Riccardi regarding the emblem showing three dolphins in the frontispiece to Galileo's book, and its possible, ambiguous meaning that might seem to allude to the three bees in the Barberini coat of arms.[457]

Galileo left his home to go to Rome on 20 January 1633. The carriage on which he traveled was stopped on the border of the Papal States because of mandatory plague quarantine. He arrived in Rome three weeks later, on 13 February. That year, no carnival celebrations were allowed, to resume only after the plague was over. After an informal, extrajudicial meeting with Commissioner Maculano, Galileo stated that he had reread his *Dialogue* recently, which he had not revisited since 1630.[458] Trying to comfort Galileo, friends and scholars wrote in his support. The mathematician Benedetto Castelli decided not to mention the hardships of the Inquisition trial in his letters, concentrating instead on his gratitude to God for releasing Galileo from the dangers of the

[455] The Pope ordered Galileo to appear in front of the Sant'Uffizio (*OG* XIV, 398-399) and objected any delays (*OG* XIV, 439).
[456] 4 September 1632; *OG* XIV, 379-82.
[457] Magalotti recalled that the logo and motto were from the printer Landini, as he had seen the same emblem in the frontispiece of a book on plague, *Compendio d'avvertimenti per preservazione e curazione della peste*, by the Portuguese physician Estêvão Rodrigues de Castro (7 August 1632; *OG* XIV, 368-371).
[458] See Galileo's second deposition, 30 April 1633; *OG* XIX, 343.

plague.[459] Meanwhile, Castelli had interceded for Galileo to receive a stipend raise, but it was not possible to receive the full stipend during plague and war times.[460] On the other hand, Mario Guiducci reassured Galileo about the decreasing plague, so that he might not delay his return to Tuscany, possibly Siena, and stay in the countryside there, an area generally unaffected by the plague, assuaging concerns from some people who, overwhelmed by fear, exaggerated facts.[461] A few days earlier, Guiducci had been busy working to prevent and stop contagion in Florence, and organizing the forthcoming procession of Madonna dell'Impruneta, and he said that the situation in Florence seemed to be stationary, though some exaggerated accounts said otherwise[462]

The Inquisition trial against Galileo took place in a room contiguous to the Dominican basilica of Santa Maria sopra Minerva, in an area that is now part of the library of the Italian Chamber of Deputies. Six months after Galileo left his home, on 22 June 1633, he was kneeling while inquisitors read out his sentence. He was condemned for holding an opinion that had been declared contrary to the Holy Scriptures, namely that the Earth goes around the Sun. Absolution would be available if he formally recanted his errors. His book would be forbidden, and he would be imprisoned, with a religious penance imposed of reciting the seven penitential psalms once a week for the next three years. After his condemnation at the Inquisition trial, Galileo was placed under house arrest at Villa Medici, thanks to the mediation of the Florentine ambassador Francesco Niccolini, then at the palace of his friend, the Archbishop Ascanio Piccolomini in Siena, and finally in his own house in Florence. Maria Celeste asked for ecclesiastical permissions to allow her to recite the psalms for him. Later in 1633, Galileo could return to his villa in Arcetri, where he could see his daughters at the convent and a few family members and friends, but he could not

[459] 19 May 1633; *OG* XV, 126.
[460] 26 May 1633; *OG* XV, 133-34.
[461] "[…] la gente spaurita dice assai più che non è" (4 June 1633; *OG* XV, 147-148).
[462] 21 May 1633; *OG* XV, 130-31.

go to Florence. When Galileo returned to Florence, Giovanni Ciampoli congratulated him for his intellectual triumph and good health in those challenging circumstances ("Sopra tutto mi rallegro che nelle pubbliche disavventure V. S. Ecc.ma habbia saputo così bene trionfar della peste, come trionferà dell'invidia e viverà col nome sempre gloriosissimo" 23 August 1631; *OG* XIV, 289-290). In 1638, Galileo could stay, under house arrest, at his son Vincenzio's house in Florence to receive medical assistance, thanks to the Pope's permission.[463] The following year, Galileo went back to Arcetri, where he lived with his student Vincenzio Viviani and later with another student, Evangelista Torricelli.

After the Inquisition trial, secretive support of Copernican theories and displays of affection for Galileo showed constantly in letters addressed to him from correspondents who were a strong support system to the scientist on a professional and personal level. About three weeks after the Inquisition trial was over, Guiducci wrote to Galileo with good news regarding the contagion rates that were declining, and he wished for a steady emotional improvement for his friend Galileo.[464] A week later, Guiducci was optimistic about the imminent end of the plague and, very clearly, he stated that he looked forward to seeing Galileo work on topics unaffected by the Copernican ban.[465] Another view on the scientist's work and research was the one expressed by Fortunio Liceti, a physician and philosopher at the University of Padua and a caring friend, who admitted that scientific research imparted physical and mental fatigue, so he approved that Galileo did not stay up at night anymore. Liceti also informed Galileo that, sadly, two of their friends had died in Padua because of the plague (6 June 1636; *OG* XVI, 434-35). A few years later, Galileo's

[463] 6 March 1638; *OG* XVII, 310-13.
[464] 16 July 1633; *OG* XV, 181-82.
[465] "Mi par mill'anni di rivederla alla sua solita quiete, dov'ella possa, lasciato da banda gli studi dannati dalla Congregazione, attendere a gli altri che non hanno principio alcuno di sospetto, se bene non mancheranno di emuli e di invidiosi . . . Qui si continua a stare tuttavia assai bene, sì che quando ella avesse la grazia da S. S.tà, non arebbe cagione di dimorare più fuor di casa sua per timore di contagio" (23 July 1633; *OG* XV, 190-91).

eyesight began to deteriorate rapidly in 1637, resulting in blindness. Writing from house arrest in Arcetri, Galileo informed Benedetto Castelli that he had been honored to receive his kind gift of a lens, but he found it troubling to receive a gift he was not able to use anymore to look at the sky, so he returned the gift by way of a traveler stopping in Loreto.[466] Galileo felt miserable when his blindness and poor health prevented him from studying, as he wrote to the young Duke of Parma, Odoardo Farnese, who had married Margherita de Medici.[467]

In addition to the plague, Galileo and his correspondents discussed other medical issues. The scientist also had some stomach discomfort, for which aloe at that time was a general remedy. Francesco Duodo had learned the secret recipe for aloe pills from his uncle Pietro Duodo, who was a close friend of the famous physician Fabricius ab Aquapendente.[468] While Galileo was eager to try remedies patented by Aquapendente, his physician and friend in Padua, Galileo's son consulted a second doctor and questioned how effective aloe pills could be, and insisted that his father should not have any.[469] Aloe pills seemed to be quite popular in the Galilei household and a cause for

[466] 24 October 1637; *OG* XVII, 203-04.

[467] Writing to Odoardo Farnese from Arcetri, he lamented "lo stato mio compassionevole nel quale mi ritrovo, poiché per le molte mie indisposizione, et in particolare per la totale cecità, son reso inabile a più impiegarmi in alcuno degli studii che per li tempi passati sono stati cibo del mio debole intelletto" (3 September 1639; *OG* XVIII 98).

[468] "Sa V.S. come l'Ecc.mo Acquapendente era affettionato alla nostra Casa, onde al S.r Cav.r mio zio diede il vero secreto delle sue pilolle che perciò ogn'anno ne facciamo fabricare in casa con l'aloe lavato in suco di rose." He gave a box with three ounces of them, each one of them making eighteen pills ("Da qui faciamo che ogni onza faccia 18 pirole"). Galileo managed to get the recipe for aloe pills, an effective placebo designed by Acquapendente, and to double-check to make sure the composition was correct: "Le pillole di Aloè dell'Aqquapendente si fanno così. Pigliasi lib. 1 di Aloe succutrino, il quale si pesta et tamigia sottilmente, nettandolo bene da i sassetti et immondizie; di poi si mette in un piatto di terra, et vi si butta sopra libbre 1 ½ di sugo di rose, et si mette al sole, coprendolo con un tamigio rado, per le mosche, et più volte il giorno si mescola insieme; et quando è spesso come melazzo, si torna a buttarvi altrettanto sugo di rose, lasciandolo similmente al sole, coperto, et mescolandolo più volte il giorno; di poi di nuovo si torna a buttarvi un altro sugo di rose, et si séguita tanto che vi si siano buttate libbre 15 del detto sugo, lasciandolo sempre al sole; et in ultimo si lascia asciugare un poco più, sì che a pena scorra, et si ripone in una vescica di manzo, lasciandolo ancora seccar più; et dalla massa poi di volta in volta si piglia, quando si ha da usare, et si riduce in pillole" (a letter sent from Venice on 23 January 1637; *OG* XIX, 202).

[469] *OG* XIV, 264. Galileo's son had visited Mario Maccanti and asked for medical advice for Galileo's indisposition. Maccanti, the convent physician, wanted Galileo to stop using aloe pills ("[…] sono stato dal Sig.r Mario Maccanti… a lui ho raccontato la sua indisposizione, alla quale egli ha ordinato gli infrascritti remedi. Prima, dice che V. S. si astenga dalle pillole che la dice, perché l'aloe ha questa proprietà, che applicato esteriormente stagna il sangue, dove preso per bocca ha virtù apritiva e lo provoca."

dissent in the past, when Galileo's mother wanted to have some aloe pills shipped. A most determined woman, she did not give up when her son would not answer her letter in two months, so she wrote to Alessandro Piersanti who worked for Galileo, and asked him to steal a few telescope lenses and aloe pills from her son's house to compensate for the money her son would not give to support her expenses.[470]

Galileo's friends knew that he was very receptive to discussions of health, was a friend of many doctors, and that he had been a professor in Padua, one of Europe's finest medical schools. When a friend of Alessandro Sertini seemed to have contracted syphilis, they sought for Galileo's advice concerning a remedy. After trying all remedies available for syphilis, even in Bologna, another important medical school, the patient had started wondering if it might not be syphilis, and he looked for help and a remote consultation from the medical faculty in Padua.[471] The discussion of epidemics has acquired a different meaning because of the global plague emergency people at that time had experienced. With recommended practices during the plague, physicians aimed at increasing safety for those who were healthy, but also to protect those who were related to a sick patient or had been in contact with one, thus showing plans to manage social risks in communities, with varying durations, start and end dates, and limitations. Similarly, the study of syphilis integrated therapy and preventive measures, and it is here integrated to the historical study of the plague because both diseases are epidemic in nature, with the significant difference that plague had been known for centuries, whereas syphilis seemed to be a new disease, according to most

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See Giulia Calvi, *Histories of a Plague Year. The Social and the Imaginary in Baroque Florence*. Berkeley: University of California Press, 1989: 212 (trans. Dario Biocca and Bryant T. Ragan; originally published in Italian as *Storia di un anno di peste*. Milan: Bompiani, 1984).

[470] Giulia Ammannati had written a letter from Florence to one of Galileo's servants, indicating how the theft was to be performed in her son's house in Padua ("in fondo di uno scatoline empiendo il resto di pillore di Acquapendente di quelle che portai io qua, e questo ve ne prego caldamente poiché Galileo è tanto ingrato." 9 January 1610, *OG* X, 279).

[471] "[…] un gentilhuomo palermitano, amico mio . . . per una indisposizione, cred'egli, di mal franzese, la quale gli tiene pieno il capo e la testa di volatiche, cosa che danno brutezza, facendo scorza e forfora." The passage is quoted from a letter by Alessandro Sertini (5 August 1608; *OG* X 218-19).

physicians. Once there was an understanding that both plague and syphilis were epidemic in nature, some physicians wrote books on both epidemic diseases, first in Latin and then in Italian, as Niccolò Massa did. Plague, then, serves as a contrast to syphilis, for scale, frequency of medical and literary discussions, and medical methods. As seen in the words of early modern authors discussed in this chapter, those affected by syphilis recorded their daily routine, medical facts, and the history of their emotions, too.[472]

[472] See the recent articles by Nathalie Proulx and by Audra Burch on *The New York Times* (2020). At times, we share those thoughts with loved ones on the phone and online. Some have recommended journaling our experience of the pandemic, the lockdown, and the isolation at home: for example, the Library of Congress and *The New York Times* have encouraged narratives written by readers, as valuable sources to collect for future historians. Writing about our feelings and everyday routine might help to find comfort at the idea that there is a potential reader, out there, who might empathize, both writer(s) and reader(s) knowing similar circumstances of isolation, fear, and loss. From such perspective, this collective narrative participation corresponds to Philippe Lejeune's "autobiographical pact" professing the identity of author, protagonist, and narrator (Lejeune 1989).

4. Narrating Syphilis in Poems and Prose.

As for plague, the perspective of the history of medicine gives some contexts on the origins and early cases of syphilis. On a wider scale, the impact of the disease was both physical and psychological, and medical books on syphilis assessed patients' health and disabilities.[473] At a physical level, patients often had different sensorial perceptions and an altered sense of space, time, and memories, which artist Cellini recorded in his autobiography.[474] While the study of diseases marked differences between a healthy and sickly condition, it also opened reflections on concepts of supposed normalcy, the description of physical and psychological skills, and the impact of possible disabilities caused by syphilis. Moral stigma and social shame, however, were quickly associated with that disease.

It was a poet, Antonio Cammelli, who first described his experience with syphilis in the Italian vernacular.[475] In 1494, Cammelli and his two sons contracted syphilis, and the author believed that contagion was concurrent with the presence of the French army in Italy.[476] One of his sons was accused of sodomy and the other one died of syphilis in 1501. Cammelli wrote a letter to the Marquis of Mantua on 10 January 1501, explaining his personal pain and distress, and that of his family ("la importunità de la mia galicha egritudine", "the distress of my Gallic malady"). He also denounced medical malpractice on behalf of one of his sons, and demanded justice because a Spanish charlatan had failed to cure him. Not only he had promised no pain or sores in the mouth,

[473] On the contrast between normalcy and disabilities, see Elizabeth Bearden, "Before Normal, There Was Natural: John Bulwer, Disability, and Natural Signing in Early Modern England and Beyond." *PMLA*, January 2017, volume 132, number 1: 33-50. Bearden studied the book *Philocophus; or, the Deaf and Dumbe Man's Friend* (1684).
[474] Completing sensorial perceptions would be possible, as Bulwer emphasizes the benefit of his discovery about the interdependent nature of the senses for Deaf people specifically, focusing on techniques in which vision assists hearing, such as signing and lipreading (Bearden 38).
[475] Antonio Cappelli and Severino Ferrari, eds. *Rime edite ed inedite di Antonio Cammelli detto il Pistoia*. Livorno: Francesco Vigo, 1884. *Opere*, 'Appendice,' VIII, pp. xlix-li.
[476] "Il re di Francia è in Roma.— In Roma! e dove? / — Dentro in san Marco con la sua brigata. / Correa in decembre, quando fu la intrata, / novanta quattro a giorni vintinove" ("Sonetti politici", II 1494, pp. 4-5).

both of which were side effects of mercury, but the young man could not recover.[477] In one of those poems on the French disease, Cammelli addressed the disease and the physician as well, with a pun on 'stilo.'[478] His perspectives as an author emerge as a key to understanding suffering, medical malpractice, and affinities between writers and physicians through literary style and lancets respectively.[479]

Another experience of syphilis was represented by Cellini both as an artist and as a writer. Benvenuto Cellini (1500-1571) worked across media as a goldsmith, sculptor, and the author of art treatises and an autobiography. In his autobiography (*Vita*), he narrated his personal and artistic memories as an ideal Renaissance man who could master both figurative arts and literary work to express his extraordinary artistic skills and understanding of nature and human nature. The autobiography by Cellini, which provides textual evidence of his illnesses, remained, however, a piece of unpublished prose for over one hundred and fifty years, whereas his artworks became famous in his own times. It was a physician named Antonio Cocchi who first published the autobiography by Cellini in 1728 (Guerrini 2002). Cocchi used Cellini's autobiography as a

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[477] "[…] tanta ingiuria ch'io ho da uno ermedario spagnolo ricevuta, el quale medicando va questo morbo francioso: e quella noti il caso, che havendo io uno mio figliolo involto nel male di sopra detto, piagato in più lochi della persona, desiderosa di farlo guarire scrissi a Zan Cristofano romano scultor de la Excelentia vostra, che parlasse al detto medico, e li scrissi precise tutta la sua malatia"; "di lì a otto giorni torneria con una cierta polvere a sanare le dette piage, e così di otto in otto dì per fin che 'l seria guarito veneria. Promessemi che male in bocha non li veneria".

[478] "O medico mio car, pur pianamente / se lo stil tocca il vivo, fa romore. / Ohimei! lo tocca! che stil traditore, / e' ti fa male senza dir niente. / — Lassiamo andar, passerà questa gente. / — Passi chi vuol che m'è passato il core: / il Petrarca cantò dolce d'amore, / et io canto d'amore amaramente. — Sia pur con Dio, ancor non torna maggio / noi udiren qualche strana novella." — (13-14). From "Sonetti satirici e faceti", IV, p. 192).

[479] "Sonetti satirici e faceti" in the modern edition. "di nuovo eletto tra' baron di Francia / [Or] ho un spuntone in spalla, or una lancia; / ogni notte ho le doglie e nol fo mai: / un riso rappresenta mille guai: / vò in contrappeso come una bilancia" (4-8); "Ognun di mille bolle è caricato, / e mai avian dal papa un benefizio; / sì che 'l nostro sperare è disperato" (12-14) ("Sonetti satirici e faceti" I, p. 189).

"Madonna, alla franciosa io son vestito, / di nuovo, come un gatto, imbullettato, / e sotto e sopra e dinanzi e da lato / per tutte le mie carni io son fornito (1-4); "quando interciso son, quando squartato, / son come un porco ogni notte arrostito" (7-8). From "Sonetti satirici e faceti" II, p. 190).

"Madonna, non bisogna ch'io vi scriva / come i ginocchi e i piedi miei mal vanno, / li bitorzol che dentro chiusi stanno / del medico hanno sempre aspettativa" (1-4). From "Sonetti satirici e faceti", III, p. 191). Cappelli and Ferrari, the editors of the 1884 edition volume, called that section the "French disease" ("Il mal francese").

primary source to learn about medical topics from pre-modern times, and his investigations inspired many medical and historical studies, among which the recent analysis on correlations between syphilis and malaria by Wolf (2005).

Doctor Cocchi had found the manuscript titled *Vita di Benvenuto Cellini* ("The Life of Benvenuto Cellini") that he edited and published in the original Italian vernacular in Köln and Naples, adding an introduction that he wrote (Cellini, ed. Cocchi 1728). Like Cellini, Cocchi was a polymath and lifelong learner. After becoming a physician, he self-taught several ancient and modern languages so that he could read classical texts on science and medicine in their original Latin, Greek, Hebrew, and Arabic. He appreciated ancient books as textual and material sources to study the history of science and medicine, and he thus purchased manuscripts by Galileo Galilei as well as the whole library of Vincenzo Viviani who studied under Galileo's supervision and was the author of Galileo's biography.

Cellini's autobiography is an incomplete text, judging from the abrupt ending, mid-sentence, describing a trip of the Medici family in Tuscany, and the manuscript was not an autograph in Cellini's handwriting. In the opening pages of the text, the artist admitted that he had dictated his memories to a servant, in his workshop, possibly between 1558 and 1562. The text was, in any case, a remarkable source of medical information to Cocchi, who could use his medical expertise and philological skills to study Cellini's physical conditions and behavioral traits. For example, he explained signs and feelings described by Cellini, which he believed were partly caused by beliefs in visions and magic. Cocchi became interested in the physical and psychological experiences that Cellini described in his autobiography, such as malaria, recurring fevers, syphilis, and injuries that the artist experienced and narrated in the first person.

Cellini dictated the autobiography to a servant and the resulting text is divided into two

parts, or books.[480] That text, in prose, "reformulated . . . through the style and manner of writing itself, the relationship between the self, the text, and the artifact," as Turello argued.[481] Among the facts he narrated, he also discussed several health experiences and his reflections on those. Because of Cellini's artistic accomplishments, medical and physiological studies on the artist were frequent during the influence of Positivism, starting in the eighteenth century. Art historians, instead, studied artworks that became famous, such as the saltcellar and the Perseus sculpture, to discuss analogic representations of nature and symbolism in Cellini's productions.[482] As a versatile Renaissance artist, Cellini both made statues and wrote books on art (*Trattati*) and on his life as a form of art.[483]

Experience was a touchstone, according to Cellini, because it allows an artist to go further and perfect a technique. For his Perseus and for Medusa, he needed to run both preparatory studies and trials, based on anatomical studies and attempts at mastering the bronze through an iron structure.[484] The accurate knowledge of anatomy was also a criterion that would increase, or decrease an artist's reputation, so Cellini may have felt it necessary to pursue his interest in anatomy further after he received criticism on precision and accuracy for anatomical details from fellow artist Bandinelli and the commissioner, the Medici Grand Duke. In that situation, Cellini argued he could represent nature better, as he could see it better first.[485]

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[480] On the genre of Cellini's *Vita*, see Cervigni (1978): 15; Turello, 284.
I have examined connections to medical humanities in Cellini's autobiography and the Perseus sculpture, through digital humanities tools in a forthcoming article, "Art at the Time of Syphilis: A Medical Narrative in Benvenuto Cellini's Autobiography." *Interdisciplinary Digital Engagement in Arts & Humanities* (IDEAH), 2021.
[481] Turello 280.
[482] On the saltcellar, II, 2; on the Perseus, II, 53, 57, and 63.
[483] Paolo L. Rossi, "Parrem uno, e pur saremo dua". The Genesis and fate of Benvenuto Cellini's *Trattati*," 171-98; Margaret A. Gallucci, "Benvenuto Cellini as Pop Icon," 201-21.
[484] "[…] innanzi che io mi mettessi a gittare il mio Perseo io volsi fare queste prime diligenzie… dico quei moderni ch'hanno saputo lavorare il bronzo" (II, 63); "Avendo di già condotto la figura della gran Medusa… avevo fatto la sua ossatura di ferro: di poi fattala di terra, come di notomia… io la cossi benissimo…" (II, 61). See Gallucci 345.
[485] "[…] questi antichi non intendevano niente la notomia, e per questo le opere loro sono tutte piene di errori"; "Bandinelli si è composto tutto di male, e così ei è stato sempre; di modo che, ciocché lui guarda, subito a' sua dispiacevoli occhi, se bene le cose sono in sopralativo grado tutto bene, subito le si convertono in un pessimo male.

In the context of Cellini's experience of syphilis, it will be useful to discuss the statue of Perseus (1545-1554) commissioned by the Medici family.[486] Contemporary with some of those artworks, one finds that Cellini struggled with the French disease ("morbo gallico") at the time of casting the statue of Perseus. A leading theme for Cellini's life and health is one of the few aphorisms in the *Vita*, an inscription from a mirror his father had made, on which a Latin distich was inscribed: "I am a wheel and virtue is always wherever I turn" ("Rota sum; semper, quoquo me verto / stat virtus"). Such statement looks like a convincing visual metaphor, while it is also emblematic that it would be a mirror to convey such abstract message, allowing the artist both to reflect his physical features on the surface of the mirror, and to show his inner thoughts on that circular, personal life history expressed in that aphorism, almost in a prophetic tone.[487]

Based on Cellini's autobiography, one could say that the artist alternated between cycles of negative experiences, such as diseases and accidents, and positive periods of enthusiasm, happiness, and pleasure that he experienced at the time of his artistic production.[488] Scholars have identified a "ritual practice," "spiritual exercise," or "technology of the self" in Cellini's attempt at finding harmony. In terms of personality and medical humors, Cellini also found himself to be melancholic and choleric, conditions that his physicians did not ignore.[489]

For Cellini, working as a sculptor and writing his memories are part of the same self-

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Ma io, che solo son tirato al bene, veggo più santamente 'l vero" (II, 70). A modern anatomist, Vesalius, is never instead mentioned by Cellini (Carter, 318).

[486] Jane Tylus, "Cellini, Michelangelo, and the Myth of Inimitability," 7-25 in *Benvenuto Cellini. Sculptor, Goldsmith, Writer*, eds. Margaret A. Gallucci, Paolo L. Rossi; also, Jacobs 172-74.

[487] Cellini I, 5.

[488] While this study investigates syphilis as the main case study, I would like to remind the reader about the great number of orthopedic injuries, which could prove to be worth exploring in further study. For instance, see Cellini I, 88; I, 109.

[489] See Gallucci, 137; Rudnev, 33, on pleasures as a medicine, and Camesasca 8. No wonder Cellini got so upset with the king's mistress: "Di grazia, monsignore tesauriere, fatemi donare un sol bicchier di vino e un boccon di pane, perché veramente io mi vengo manco… per essere alquanto troppo colleroso, mi offende il digiuno di sorte che mi faria cader in terra isvenuto . riauto gli spiriti vitali, m'era uscita la stizza" (II, 23, p. 319).
On his anger, "m'accrebbe tanto còllora che, tirato tutto al male e anche per natura alquanto collerico" (Cellini I, 17).

fashioning mode. First, he started writing poems to reflect on his personal experiences while working on the Crucifix sculpture that he completed in 1562, now at the Escorial.[490] In the opening lines of his autobiography, before narrating his first memories, Cellini wrote a poem to express his gratitude to God:

> Questa mia Vita travagliata io scrivo
> per ringraziar lo Dio della natura,
> che mi diè [sic] l'alma e poi ne ha 'uto cura:
> alte diverse 'mprese ho fatte e vivo.[491]

While the phrase "God of nature" is common in the sixteenth century, Cellini's understanding of nature and human nature is a recurrent theme in his autobiography and a visual clue in his artworks. Such observations across media and texts build on Michael Cole's argument that sculpture and literature would be equal and comparable activities, and on the authorial connection between autobiographical text and artwork that Turello has demonstrated.[492] Thus, I will discuss Cellini's narration about plague, syphilis, and an unusual fever at the time of casting his Perseus as an anomaly of nature that the artist somehow overcame.[493]

The statue representing Perseus made Cellini's peers talk about the idea of producing a work of art out of ordinary matter, as opposed to copying truth that had been a common topic of discussion and competition among artists, since Michelangelo's days.[494] The sculpture of Perseus by Cellini represents a universal, atemporal ideal encompassing all ages of man, according to

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[490] See Cole 62-66. Oppenheimer (1845) discussed Benvenuto Cellini's ideas on sonnets and audiences.
[491] "I write this troubled life of mine / to thank God, [the creator] of Nature, / who gave me life and then took care of it: / I have accomplished several high feats and I am alive". Translation mine.
[492] Cole 162.
[493] Turello 287-89, on physical energy, diet, and artistic production. About 'fusione' and 'infusione,' see also Cole 219-230.
[494] The statue is also made of bronze, a rare material to retrieve, compared to marble in Tuscany. See Michael Cole, "Universality, Professionalism, and the Workshop. Cellini in Florence, 1545-1562," 53-70. Cellini had also collaborators (57-60). See also Martina Belozerskaya, "Cellini's Saliera. The Salt of the Earth at the Table of the King," 71-96, with comments on symbols present in the famous saltcellar (89-92) and Philip Atwood, "Cellini's Coins and Medals," 97-120.

Trottein.[495] Under the statue there is a pedestal, with four niches featuring Venus and Mercury. In Wolf's interpretation of this mythological proximity, Cellini would have "demonstrated the cause and cure of his disease."[496] Cellini might have been alluding to the popular saying that one night with Venus would bring a lifetime with Mercury, alluding to the fact that sexual intercourse might cause syphilis, for which the remedy was mercury.

From Medusa's severed head, coral would spring up, according to a reading of Ovid's passage about Perseus, in the Italian versions circulating in the Renaissance. Passages from Pliny the Elder's *Naturalis Historia*, a popular source for encyclopedic information, mentioned the supposed therapeutic powers of coral, as well as its magical uses. In the mid-sixteenth century, collections of coral had a remarkable position in the Medici 'guardaroba' (Archivio di Stato di Firenze) and, later, at Palazzo Pitti, where one room today holds part of the coral collections. [497] Coral collections seem to strengthen the Medici intention to return to power after the Florentine republic experience, so that the Perseus statue and the coral iconography convey a message of strength and energy that is both physical and political. The theme of Medusa was also an important allegory that Gardner Coates has studied across statues and objects made by Cellini as a goldsmith.[498] The detailed representations of blood, according to Cole, shows that "its flow could become the origin of art itself." In addition to that, the presence of blood represented political

[495] "From childhood (the boy Perseus) to adolescence (Mercury), to young manhood (Perseus), to maturity (Jupiter), to old age (the Janus mask), all the ages of man are present in the monument, but not the ages of woman. The triumph of 'virtù' is a masculine affair, as the word's Roman origin indicates" (142). The theme of Perseus rescuing Andromeda had also appeared in a bronze relief by Cellini, as an emblem of Fortune (Gwendolyn Trottein, "Cellini as Iconographer," 123-47; 144-45).
[496] Wolf 1458-9.
[497] "This adds a Plinian dimension to the *collecting* of coral, and we need to see Medusa's blood not merely as the product of Cellini's inspired fantasy but also as an ornament central to his patron's interests. Recognizing coral – and knowing its potency – the viewer must take even the *Perseus*'s propagandistic intentions to involve more than menacing would-be rebels with beheading or recording the violent appropriation of the piazza's space" (Cole 227-9).
[498] A medallion of Medusa had been inserted on the bust of Pope Clement VII, as a central clasp to hold his cape and "a sort of signature for the artist" (Victoria C. Gardner Coates, "Cellini's Bust of Cosimo I and *Vita*," 148-68; 150).

meanings for the Medici family, as an allegory for Cosimo's victory over his enemies.[499] Furthermore, blood from Cellini's Medusa also serves a mythological purpose and its parts are called *gorgoni*.

[499] Cole 217.

Figure 10. Benvenuto Cellini, *Perseus Holding the head of Medusa*, ca. 1545-1554. Loggia dei Lanzi, Florence. Courtesy of Wikimedia Commons.

In addition to syphilis, the plague was often mentioned in Cellini's autobiography.[500] A severe outbreak of plague occurred in Rome in the summer of 1524, when a famous doctor visited him.[501] Though the doctor was on a cardinal's retainer, he acknowledged the artist was an extraordinary person and helped him.[502] He warned the artist, though, that he was in danger because he had had intercourse. Cellini, however, pointed out that the woman was too young to be a prostitute, so the danger of contagion seemed lesser than anticipated, but the doctor still insisted to follow up on his case.[503] In addition to physical care, psychological considerations were important, according to doctors, for patients affected by epidemics, thus living in isolation, and Cellini recorded some pastimes he found helpful to fight melancholy during epidemic outbreaks.[504] Doctors suggested that patients should have hobbies and maintain a good attitude, and Cellini found it helpful if he could go for a walk, look at antics around Rome, or go hunting[505] Overall, pleasures were, for him, "like a medicine able to conjoin the celestial and terrestrial worlds as well as the profane and sacred, individual soul and 'the One', matter and art," literary critic Rudnev

[500] "Appressandosi all'ora del desinare, onde io stanco, che molte miglia avevo camminato, volendo pigliare il cibo, mi prese un gran dolore di testa, con molte anguinaie nel braccio manco, scoprendomisi un carbonchio nella nocella della mana manca, dalla banda di fuora… passando per la strada il padre di questo mio fattorino, il quale era medico del cardinale Iacoacci ed a sua provvisione stava, disse il detto fattore al padre: - Venite, mio padre, a veder Benvenuto, il quali è con un poco di indisposizione a letto -. Non considerando quel che la indisposizione potessi essere, subito venne a me e, toccatomi il polso, vide e sentì quel che lui volsuto non arebbe. Subito vòlto al figliuolo, gli disse: - O figliuolo traditore, tu m'hai rovinato: come poss'io più andare innanzi al cardinale? - A cui il figliuol disse: - Molto più vale, mio padre, questo mio maestro, che quanti cardinali ha Roma -. … con lo aiuto di Dio e, con i maravigliosi rimedi cominciato a pigliare grandissimo miglioramento, presto a bene di quella grandissima infirmitate campai" (*Vita* I, 29). See also *Vita* I, 39.

[501] On plague and Renaissance theories on plague derived from Marsilio Ficino's books, see Rudnev, 30-33.

[502] "[…] e val più le scarpe di Benvenuto che gli occhi di tutti questi altri balordi" (*Vita* I, 45).

[503] *Vita* I, 27.

[504] Carter 319.

[505] "[…] il gran piacere che io traevo da questo mio scoppietto mostrava di sviarmi dalla arte e dagli studii mia…tutte le volte che io andavo a questa mia caccia miglioravo la vita mia grandemente, perché l'aria mi conferiva forte. Essendo io per natura malinconico, come io mi trovavo a questi piaceri subito mi si rallegrava il cuore, e venivami meglio operato e con più virtù assai che quando io continuo stavo a' miei studii ed esercizii" (I, 27).
Hunting was a pastime also in his recovery from syphilis (I, 59). However, outdoor exercise worsened his condition, which prompted him to take guaiac ("[…] quattro giornate di questa santa acqua de il legno") again, against the doctors' advice. Sexual moderation improved his creativity, and he was fully healthy in fifty days.

argued.[506] It is also clear that surrogate pleasures served well the purpose of bringing peace of mind to Cellini, a distressed artist at the time, thus working as a form of medicine. Additionally, not only plague and syphilis intersect historically, but also plague and malaria co-occur in areas around Rome until the early twentieth century. The Italian word for plague ("peste") seems synonymous with malaria in Cellini's text, according to Carter's and Wolf's studies. Malaria, which translates as "bad air," was a common epidemic disease, of which I found three major outbreaks in the autobiography.[507]

Medical studies have documented the co-occurrence and malaria and syphilis, both of which caused Cellini to suffer fevers, rash, and megalomania. What Cellini experiences as "elevating his soul from the physical struggles to aesthetic contemplation of the divine" is, in fact, also interpreted by scholars as a form of coping with circumstances, from artistic celebrity to a more modest lifestyle.[508] Some of the artist's distress seemed to derive from poor communication with his commissioner, the Grand Duke, and from competition with fellow artists in Florence. At one point, Cellini sounded impatient with the Duke who had commissioned him a statue to feature in Loggia dei Lanzi, which eventually became the Perseus statue. Cellini often mentioned wanting to complete his Perseus, so that he could avoid any interactions with his commissioner, control his own feelings, and stop any physical and emotional distress.[509] At the same time, the casting of the Perseus, in Cellini's words, bears resemblance to child-bearing, and scholars have discussed the role of bronze as an alchemical element that carries life within it.[510] In Cellini's words, making the

[506] Rudnev 30.
[507] I, 11 (Page 24); II, 5 (page 287); II, 113 (Page 474).
[508] Rudnev, 29.
[509] "[…] con tutto questo io certamente mi promettevo che, finendo la mia cominciata opera del Perseo, che tutti i mia travagli si doverriano convertire in sommo piacere e glorioso bene" (Cellini II, 75).
[510] "The idea that bronze could be brought to life is not something Cellini made up. It draws on conceptions about metals that he would have understood as both ancient and contemporary, scientific assumptions about their nature, their origins, and their potential" (Cole 222).

Perseus resembles a woman's pregnancy and her experience with childbirth, so the artist imagined himself as a mother lying-in with her newborn once he had his full Perseus statue.[511]

During the Perseus statue project, Cellini likely suffered from syphilis that he claims to have contracted in 1529. According to Wolf, in the secondary stage of the disease, characterized by "a vesicular rash," Cellini refused mercury therapy for fear of side effects.[512] Doctors gave him, instead, ointments and leeches, which helped momentarily with the so-called syphilis pox skin rash. When Cellini later contracted malaria, he had a fever, and such condition "led to improvement of his symptoms following attenuation of the spirochetes by the high fever" according to physician Wolf. The interaction between malaria and syphilis had been noted as early as 1539 by physician Roy Diaz De Isla, who had also noticed that malaria interacted with syphilis with a "minimal therapeutic value" on syphilis.[513] The co-occurrence of those ailments and the artistic production seemed to be a central event in Cellini's life, as he recorded those facts as connected in his written memories. Cellini seemed aware that sexual contact caused contagion and syphilis. There was, however, also an understanding of astrological conditions that would contribute to spreading out syphilis.[514] In particular, the alignment of Mars, the man-like god of war, and Venus, the goddess of beauty and love, would be considered to cause such epidemics.[515]

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[511] Cellini I, 59.

[512] In contemporary times, Coe discusses "the ferocious medicines" and the "torture by medicine" (Coe, 220-1).

[513] Wolf (1457-58) also records later claims to an effect between malaria and syphilis: "Four hundred years later, in 1927, the Nobel Foundation awarded a Nobel Prize to Julius Wagner Jauregg for malaria therapy of syphilis, which was ineffective, as demonstrated in Cellini's case in 1529." Cellini commented that he recovered in fifty days: "In capo di cinquanta giorni io fui benissimo guarito, e di poi con grandissima diligenzia io mi attesi a 'ssicurare la sanità addosso." That description would be compatible with a recovery from a mercury poisoning. Cellini acknowledged he had misplaced his trust because the people who attempted poisoning him were relatives of his friend, Guidi (II, 102). See Carter 326-7. Wolf stated that the half-life of mercury poisoning is 40 days (1457-8).

[514] "Ergo contagum quoniam natura genusque / Tam uarium est, et multa modis sunt semina miris / Contemplator et hanc, cuius coelestis origo est" (Fracastoro, *Syphilis*. Page 8, Lines 157).

[515] "Pestem atrox…miscebat Mauors" (Fracastoro, page 16, line 12).

Symptoms of syphilis varied from patient to patient, but skin rash, vision impairment, breathing problems, lymphatic swellings, and joint pain would all help a Renaissance doctor diagnose it.[516] Several church members had been affected by syphilis, too, as Cellini noted.[517] Syphilis doctors were in high demand in Rome, where Cellini had a chance to meet the famous physician Berengario da Carpi ("maestro Iacopo cerusico da Carpi").[518] Berengario da Carpi had been in Rome for six months after the beginning of the plague, and in the meanwhile he had become popular thanks to an ointment he claimed to have invented for the cure of syphilis.[519] The artist considered him a good physician for general practice, but called him a charlatan as concerns syphilis.[520] When Cellini's syphilis became tertiary, according to Wolf and Carter, he started working on his sculpture of Perseus. Cellini believed that a miracle had occurred in the bronze alloy and saved the statue from overheating.[521] In the furnace, there was a rumble and a lightning, which called for more metal to melt, and Cellini gathered everything he could from his kitchenware. Then, he prayed God, had dinner with his employees, and he managed to recover his health afterwards, once the statue was safe.[522] The final solution to his problems with syphilis occurred accidentally, when some people had conspired to poison Cellini, to have some lands

[516] "Carpere tabem oculos, sed sese immergere in imum / Pulmonem et pomis quamquam sit mollior uua" (Fracastoro, page 12, lines 9-10); "artus / Brachiaque scapulaeque" (page 14, lines 56-57).
[517] Cellini believed he had seen a syphilitic assistant to a cardinal (I, 32).
[518] See R. K. French, "Berengario da Carpi and the Use of Commentary in Anatomical Teaching," in Wear 42-74.
[519] Berengario da Carpi "prese certe disperate cure di mali franzesi… questi mali in Roma sono molto amici de' preti, massime di quei più ricchi… ma voleva far patto prima che cominciassi a curare; e' quali patti, erano a centinaia e non a decine."
[520] *Vita* I, 28. As Carter insisted, however, Berengario da Carpi was "no charlatan as he appears once in the memoirs, but an able surgeon and physician, a reviver of anatomical knowledge. Carpi was of the true spirit of the Renaissance." (Carter 317).
[521] He discussed it as seeing someone come back to life after death ("[…] veduto di avere risuscitato un morto, contro al credere di tutti quegli ignoranti"). "The analogy with Christ, whose death seems to mark the ruin of his work of redemption, is more than obvious" (Cervigni, 17-18). Consequently, Cellini wrote that he recovered ("e' mi tornò tanto vigore che io non mi avvedevo se io avevo più febbre o più paura di morte").
[522] Cellini's favorite helper commented about fever as a personified entity occupying and fleeing the artist ("[…] con quel diabolico furore che voi mostravi d'avere, quella vostra tanto smisurata febbre, forse spaventata che voi non dessi ancora allei, si cacciò a fuggire," II, 76).

returned to them. They cooked a meal, one of whose sauces contained a mercury compound ("silimato"), in an amount small enough to cure his syphilis.[523]

[523] Symptoms included a severe hemorrhagic diarrhea, and many more could concur, such as "a metallic taste, stomatitis, gastroenteritis, urticaria, vesication, proteinuria, renal failure, acrodynia, peripheral neuropathy with paresthesia, ataxia, and visual and hearing loss" (Wolf, 1457-8). The poisoning episode is as follows: "[…] mi pareva che lo stomaco mi ardessi… mi si mosse 'l corpo… trovai la pezza molto sanguinosa. Subito io mi immaginai di aver mangiato qualche cosa velenosa… una presa di silimato (perché il silimato fa tutti quei mali che io mi vedevo d'avere)" *Vita* II, 104-105; "[…] andavo a lavorare alla ditta Loggia il mio gigante tanto che, in pochi giorni appresso, il gran male mi sopra fece tanto che ei mi fermò ne' letto… Così malcontento mi stavo in letto e mi facevo medicare da quello eccellentissimo uomo di maestro Francesco da Monte Varchi (F. Catani da M.V.) fisico, e insieme seco mi medicava di cerusia maestro Raffaello de' Pilli" (II, 115). Cellini informed the Duke about this attempted poisoning ("[…] perché il veleno non fu tanto che egli mi ammazzassi ma sì bene ei fu appunto tanto a purgarmi di una mortifera vischiosità, che io avevo dentro nello stomaco e negli intestini; il quale à operato di modo che, dove, standomi come io mi trovavo, potevo vivere tre o quattro anni, e questo modo di medicina à fatto di sorte che io credo d'aver guadagnato vita per più di venti anni; e per questo con maggior voglia che mai più ringrazio Iddio," *Vita* II, 108); see also Cervigni 19-21.

5. Narrative Medicine: Physicians Narrated Plague and Syphilis.

In addition to medical narratives, in which people describe their firsthand experiences of illness, this study adopts the approach to narrative medicine developed by Rita Charon, who has recently advanced a new interpretive method of textual and oral analysis of patients' narratives. Drawing on her experience as a scholar in the humanities and a trained physician, Charon argued that scientific expertise is not the only knowledge required for doctors. Physicians also need to listen to their patients, and that task becomes easier when people connect through stories. Thus, narrative medicine includes both technical and humanistic knowledge for healthcare providers.[524] By listening to patients' narratives, doctors would be able to understand the difficulties experienced by them, and to learn from what they observe as doctors while honoring their patients' narratives of illness. It is here argued that, in the early modern period, both methods were valid perspectives for a textual and visual presentation of human experiences.

While I examined firsthand experiences of health and illness in the previous section in what I call medical narratives, here I will analyze medical texts elaborating on patients' experiences corresponding to Charon's 'narrative medicine.' In the medical community, the study of epidemics integrated case studies and medical narratives, to textual descriptions of signs, therapy, and prevention practices in the early modern period. Illustrated visualizations of healthy and sick bodies helped to understand the propagation and consequences of the plague and syphilis, and to distinguish among a variety of ailments that could look like plague, for example, such as some forms of tertiary and putrid fevers, swellings and carbuncles (bubo, *carbone*, *petecchie*), and typhus.[525] By browsing through historic dictionaries, such as the *Tesoro della lingua italiana delle*

[524] Rita Charon, *Narrative Medicine: Honoring the Stories of Illness*. New York; Oxford: Oxford University Press, 2008: 3-62.
[525] Cipolla, 90; Cohn 2012, 17.

origini, it is shown that *pestilenza*, *contagio*, *contagione*, and *pestifero* were common words to refer to plague, contagion, and plague-bearing items and air. From *Tommaseo-Bellini* (*Tommaseo online*), we find words such as *antipestilenziale*, *bubbonico*, *peste*, *pistolenzioso*, *ghiandosa*, *glandole* or *gavoccioli*. The *Vocabolario degli accademici della Crusca* also provides historical evidence of the use of words and phrases across time, in particular in the third volume integrating scientific terminology from Galileo's books.[526] The *Crusca* dictionary preserves words derived from Latin such as *contagione*, with a literal meaning, mostly for the plague, and an abstract, metaphorical one for contagious diseases, and *contagio* as a synonym of plague. Early symptoms could be swellings called *gavocciolo* which was both a sign and later became a metonymic expression for plague.[527] One could also refer to the plague by the general word for disease, *morbo*, or by the specific word *peste* that was a synonym of *pestilenza*.[528] Among adjectives, *pestifero* is a synonym of *pestilenziale* and *pistolenzioso*.[529] Verbs regarding the plague were *apopestare* or *appestare* and *infettare*.[530] A shelter for those stricken by the plague was a *lazzeretto*.[531] Though plague terminology is vast and its history long, medical treatment was not readily available nor

[526] For the dictionary published by the Accademia della Crusca, I have considered the first (1612) and second edition (1623) as relevant to Galileo's lifetime, as well as the third edition (1691) because Galileo, a member of the Accademia della Crusca, had contributed to some of the scientific entries for that edition. Guiducci, a member of Accademia della Crusca under the pseudonym of 'Ricoverato,' partly funded the 1612 first edition of the *Vocabolario della Crusca* and contributed to the third edition of the Crusca dictionary as a lexicographer, going through Galileo's works printed in Bologna in 1655 and 1656, in order to write entries for new technical and scientific words.

[527] First edition, 216; second edition, 213; third edition, volume 2, 395: "[…] influenza di male, che s'appicca, e dicesi, per lo più, della peste, per esser più contagioso." 'Contagio' in *Crusca*, third edition, volume 2, 395; 'gavocciolo' in *Crusca*, first edition, 379; second edition, 370; third edition, volume 2, 751. Galileo used the word 'gavocciolo' sarcastically in an invective against the author of *Gerusalemme liberata*, Torquato Tasso (OG IX, 122 "Considerazioni al Tasso" on canto XI, stanza 82).

[528] 'Morbo' in *Crusca*, first edition, 540; second edition, 529; third edition, volume 3, 1056); 'peste' in *Crusca*, first edition, 619; second edition, 604; third edition, volume 3, 1200.

[529] A passage in the introduction to Boccaccio's *Decameron* famously reads "la dolorosa ricordazione della pestifera mortalità trapassata". See first edition, 619; second edition, 604; third edition, volume 3, 1200; first edition, 631; second edition, 615; third edition, volume 3, 1221.

[530] 'Apopestare' or 'appestare' in *Crusca*, second edition, 120; 604; third edition, volume 2, 120; 'infettare' in Crusca, third edition, volume 2, 875.

[531] "Spedale d'appestati, e luogo, dove si pongono gli huomini, e le robe sospette di peste" in *Vocabolario della Crusca* third edition, volume 3, 943.

effective, and the causes and modes of transmission were not fully understood. Therefore, historical considerations on previous plague outbreaks advanced the perception of medicine as a discipline, starting with the sixth-century plague of Justinian in between 541 and 549 C.E.

Physicians could benefit from medical history to find more information about treatment, sanitation, and isolation. In Venice, quarantine was established during plague outbreaks, the word for it deriving from the Italian word for forty, "quaranta," as a cautionary measure.[532] Thus, when there were suspicions of infectious or contagious diseases, incoming ships, people, and products had to be offshore, away from the port. Such public health measures inspired a form of contact tracing, where medical practitioners would search for those who had been in contact with a plague victim throughout the main islands of Venice.[533]

One of the main sources of medical information on the plague is a popular textbook, the *Fasciculus medicinae* ("Bundle of medicine") attributed to Johannes de Ketham, translated by Sebastiano Manilio into Italian in 1494.[534] The text is a collection of short medical treatises attributed to Ketham, many of which derived from medieval sources.[535] The book, originally written in Latin, was translated into the Italian vernacular, and that translation integrated many terms in the Venetian dialect for the use of medical students on the Venetian mainland, at the University of Padua. In that textbook, illustrations present a form of visual narrative while also showing what a physician's work looked like.

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[532] I have investigated the 1629-1631 plague outbreak in Venice in a forthcoming article, "Gendered Epidemics: Early Modern Women and Plague in Italy." *Early Modern Women: An Interdisciplinary Journal*, 2021.

[533] Identifying and isolating relatives and neighbors of the sickly served to prevent further infectious spread, similarly to phone applications for contact tracing currently in use in countries like South Korea, Japan, Italy, and the US for the study of the transmission of Covid-19, to limit and contain the virus transmission.

[534] Manilio, a Tuscan humanist, had studied under Pomponius Laetus in Rome. He worked as an editor and translator for the publishers Giovanni and Gregorio de Gregori in Venice, in the 1490s, publishing the *Epistolae familiares* by Petrarca (1492), a Latin translation of the Greek translation of Aristotle's text *De animalibus* by Theodorus Gaza.

[535] The Italian translation contains illustrations made from new woodcuts which are more detailed than the original Latin edition, but also new illustrations and additional passages.

In the plague visitation scene, a physician's iconic features would be the gown and a urine flask, or a book hanging from his belt, and physicians in the book are represented in such traditional fashion. The medical textbook was particularly influential in medical education from the fifteenth to the seventeenth century, and it also included a popular textbook on the plague, *Consilium pro peste evitanda* (*Advice for avoiding the plague*) by Pietro da Tossignano, who taught medicine at the universities of Bologna and Padua in the fourteenth century.[536] That treatise discusses the author's specific experiences with plague patients, describing the disease, how to avoid catching it, and how to treat plague victims. The following illustration, known as the plague visitation scene, acts as a sort of frontispiece and preface to Pietro da Tossignano's book. Here, the physician covers his face with a cloth while taking the pulse of a plague patient. For the patient himself, a suffering face and the torso are shown only.[537] One of the male attendants carries a basket with a jar of urine to inspect and determine the nature of the disease, based on the theory of humors and methods in uroscopy that the textbook also illustrated in texts and images.[538] Two male attendants hold torches so that the doctor can see the patient, or possibly to burn perfumes and protect against contagious air. Three women, likely caregivers, are shown helping the patient in the background of the image. While this illustration narrates a private matter, such as a doctor's examination at the home of a patient, plague was also a matter of public health at the same time.

Physicians in training and accomplished doctors needed to be knowledgeable in matters of public health. Andreas Vesalius argued that knowledge of surgery, medications, and the

[536] The book on plague was originally printed by the Gregori brothers separately from the *Fasciculus medicinae* attributed to Johannes de Ketham. The plague visitation illustration was later appended to the end of the 1491 Latin version of *Fasciculus medicinae*, to be then integrated in the 1493 Italian edition of the *Fasciculus*.
[537] The illustration is highlighted with colors in the 1500 edition wherein the patient's torso is the color of skin, whereas bedclothes and three attendants (two men and one woman) are scarlet and green, and the physician is distinguishable because of his long, green professional gown. Illustrations in the 1500 edition (in color) and in the 1513 and 1522 editions (black and white) are almost identical regarding details represented.
[538] The so-called urine ring to examine urine is shown in the third illustration of the *Fasciculus medicinae*.

compounding of drugs was fundamental for physicians.[539] In his words, doctors should not abstain from surgery only to privilege working as physicians administering medications to be ingested, because such aversion resembles the fear for plague. No such dislike should exist within any disciplines pertaining to medicine, including surgery, general practitioner's care, and pharmacological competence within the general domains of medicine.[540]

[539] Montanus had introduced clinical medicine as part of the medical curriculum at the University of Padua, so that doctors in training could learn from specific cases, see individual patients during their time at the hospital, and also understand epidemic outbreaks as a social phenomenon.

[540] In the introduction to *De humani corporis fabrica*, Vesalius criticized the alleged supremacy of physicians over the work of surgeons. Renaissance physicians would only take care of patients' internal afflictions, whereas surgeons only used their hands and operated to restore health. The perceived superiority of physicians and, consequently, Vesalius argued that aversion to surgeons is comparable to the plague, and everyone's desire to avoid it.

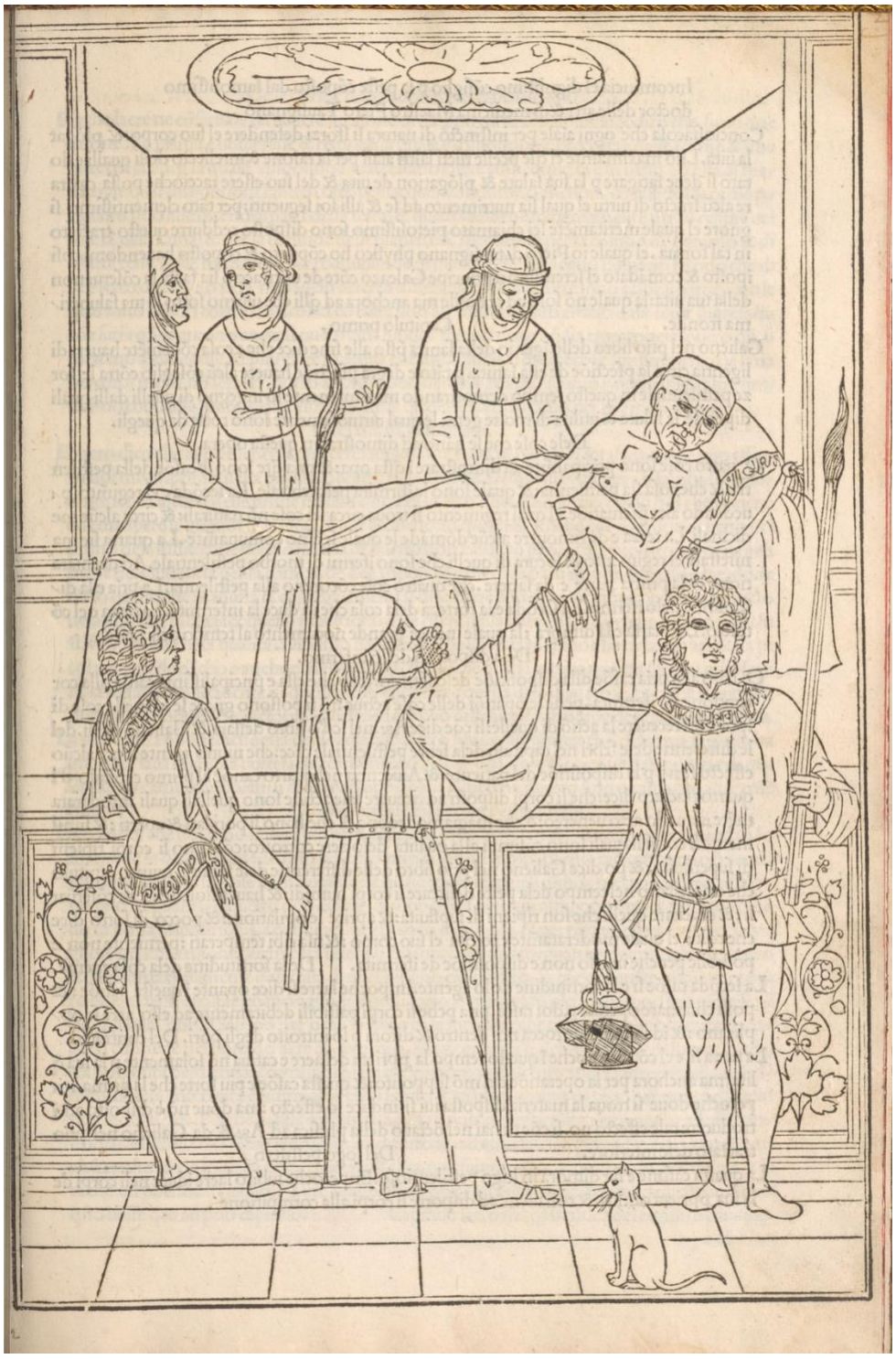

Figure 11. Plague visitation scene from *Fasciculus medicinae* (1493).
Courtesy of the National Library of Medicine, Bethesda, MD.

Such integrated interest in private and public matters was defended by another doctor, Niccolò Massa, who had written books both on the plague and syphilis. Massa had overseen a public health commission for the Venetian government during an epidemic outbreak in 1555. Responding to the College of Physicians, he was asked to ascertain, by common opinion or true science, if the current disease was plague.[541] Massa's manual written during the 1555-56 plague was very practical, to instruct individuals and governments on how to recognize the "true signs" of plague and to separate and sequester the plague-stricken in Venice, developing the idea of exposure based on social class and occupation.[542]

At this point, more should be said about medical discussions on syphilis. Physicians considered syphilis to be a new disease and the word 'syphilis' became popular after 1530, when Girolamo Fracastoro, a physician from Verona, coined it in a poem he wrote, titled *Syphilis sive morbus Gallicus* ("Syphilis, that is, the French Disease").[543] The emergence of a new disease was especially unsettling. If new diseases were possible, then medicine as a discipline could be questioned, and challenged, to find a cure for illnesses that traditional authors such as Hippocrates and Galen had not described. The status of medicine was questioned, once new ailments seemed to resist remedies proposed by authoritative texts by Hippocrates, Galen, and their medieval and Renaissance commentators. Furthermore, the fact that more diseases could arise reframed the understanding of nature as a finite collection of traits, features, humors, and balances. Such confusion for an all-encompassing science and, consequently, medicine could be resolved within

[541] Cohn 2012, 174.
[542] The results of his commissioned study contributed to understand diseases as they affect individuals, social classes, urban structures, and trading in a peculiar social structure, such as the one in Venice. See also Corradi 1870, vol. II, 202-205.
[543] Girolamo Fracastoro, *Syphilis sive morbus Gallicus*, Verona, S. Nicolini da Sabbio, 1530. I have discussed narrative aspects of syphilis texts in a forthcoming article, "Narrating Syphilis in 16th-Century Italy" to be published in a collected volume edited by Giovanni Spani (2021).

the Book of Nature metaphor, where mathematical realities would allow for further discussions of new, emerging realities throughout history and times to come.

For the supposedly new disease, Fracastoro wrote a poem in Latin hexameters for pedagogical purposes to inform readers about its transmission and therapy.[544] Because syphilis seemed to have started after recent explorations overseas, and during the first Italian war in Naples, it was commonly believed that syphilis was a new medical problem. Before the word syphilis was introduced, other names were used. It was the 'French disease' to the Italians, but the 'Italian' or 'Neapolitan' disease to the French, while people in other countries blamed foreign disbanded soldiers for introducing the infection.[545] For practical purposes, most physicians referred to the disease as the 'French disease' and as such it was known internationally.[546] Though doctors did not agree on the origin of the disease, Ulrich von Hutten believed that "a general agreement" was needed, and scholars were going to call it the French disease "for fear that not everyone may understand it, if we call the disease by another name."[547] Because of such disagreements in the medical community about the origin and therapy for the disease, scholars found the narrative genre to be most effective in medical treatises, and one early narrative case for the origin, nature, and treatment of syphilis is found in Fracastoro's poem.[548]

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[544] Fracastoro's book had more than seventy editions in one century and was translated into several languages, thus showing great interest for the topic.

[545] Anna Piro, Amedeo Elio Distante, and Antonio Tagarelli. "On Allusive Names for the Syphilitic Patient From the 16th to the 19th Century: The Role of Dermatopathology," *The American Journal of Dermatopathology* 39.12 (2017), 949-50.

[546] Another physician, Gabriele Falloppio, listed all the known names of syphilis. Additionally, he discussed the geographical diffusion of the disease, as well as the social and cultural assumptions occurring when one nation blames others for a local disease, regardless of the spread of the disease internationally (Gabriele Falloppio, *De morbo Gallico*, Padua, Luca Bertello, 1564, ff. 1r-5v).

[547] "[…] gentium consensus. . . veriti ne non satis intellegant omnes, si qualibet alio nomine rem signemus" (Ulrich von Hutten, *De guaiaci medicina et morbo Gallico liber unus*, 1524, f. I). Unless otherwise noted, translations are mine.

[548] Fracastoro was well versed in humanistic writing practices and medicine as well and was considered to be the best poet writing in Latin at the time. He was also held in high esteem for his medical expertise and was later appointed an official physician for the Council of Trent, in 1545.

While discussion of medical topics in the form of a poem might seem unusual, it was quite common for writers to address, in prose or poems, any type of contents, including science, medicine, and technology. The poem on syphilis is divided into three books, where readers find out more on the disease, its origin, and some popular remedies such as mercury and guaiac wood from the Americas.[549] Non-local remedies had traditionally been questioned by physicians and scholars, starting with Pliny's dry comments on money wasted on remedies coming from India. Additionally, the fact that it was perceived to be an exotic remedy added a perceived danger in patients, which pharmacists tried to dispel and physicians overall ignored. To explain the origin of the disease, Fracastoro invented a mythological story within literary domains, so that he could address the international remedy that had become so popular to treat syphilis. In the opening lines of the poem, the author invoked the Muse to "[…] reveal … what seed has grown / This evil that for long remained unknown!" As was customary for poems, the author requested the help of the Muse, in homage to classical conventions in poetry, but also to remind readers of the mysterious medical causes for syphilis that he was going to announce as an expert in the field of medicine and epidemics.[550] From a historical perspective, the author acknowledged that the disease had occurred when the French army captured Naples, so that it was the 'French disease' – the Latin 'morbus Gallicus' that appears in the title of his poem. Syphilus was a shepherd who had insulted the Sun god, thus causing divine wrath and a plague in Haiti. The shepherd became the first person afflicted

[549] After mercury, the herbal remedy guaiac was the second most common treatment for syphilis. For guaiac, see Ulrich von Hutten, *De guaiaci medicina et morbo Gallico liber unus*, 1524. In 1519, Ulrich von Hutten, a German knight and humanist, wrote a book on the "Gallic disease" and guaiac wood as its safe remedy. He was, however, skeptical regarding the use of guaiac to prevent syphilis, in the same he would not believe that garlic could prevent magnetism (Hutten XVII, p. 3). See also Nicholas Pol, *De cura morbi gallici per lignum guaycanum, libellus*. Per Ioa[n]nem Patauinum & Venturinum de Ruffinellis, 1535.

[550] Book I, Girolamo Fracastoro, *The Sinister Shepherd: A Translation of Girolamo Fracastoro's* Syphilidis; sive, De morbo gallico libri tres, trans. William Van Wyck, Los Angeles, The Primavera Press, 1934.

with the "disease of Syphilus," that is, syphilis.[551] The mythological narration of Syphilus that Fracastoro invented shows how storytelling is a powerful tool in science, a device that Galileo would also find useful in his fable on the origin of sounds. The origin of the disease was not clear, though, and scholars searched for a rational explanation to ease their fears regarding a problem that had affected many people in Europe, as "[…] in every place beneath a clamorous sky, / There burst spontaneously this frightful pest."

Since the sixteenth century, scholars have argued whether soldiers caused the first syphilis outbreak in Europe, or Columbus brought syphilis to Europe from the New World.[552] Fracastoro had claimed that syphilis was air-borne and had not mentioned it as a primarily venereal disease.[553] The concept of plague transmission and syphilis contagion was based around gradual exposure to the pathogen, and in the case of syphilis, the so-called Colombian hypothesis has been supported by recent medical studies.[554] Understanding where syphilis originated was a priority among health

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[551] Writing poems on medical topics was not unusual. See Charles L. Dana, *Poetry and the Doctors*, Woodstock, Vt.: Elm Tree Press, 1916: pp. xv, xxi, 26-27.

[552] According to Vivian Nutton, the rise of medical humanism began in 1490 with the book *On the Errors of Pliny and Other Doctors in Medicine* by Leoniceno. Nutton maintained that the outbreak of the great pox posed a methodological problem, because physicians needed to study and solve a new problem. In 1525, the publication of the first edition of the works of Galen in Greek (Aldus, Venice) was a corpus containing 106 texts of which 46 had not been previously published: also, Flavio Calvo's publication of the Hippocratic Corpus in Latin. In 1588, the publisher Giunta published the corpus of works by Hippocrates in a bilingual edition. Another influential medical textbook was Juan Valverde de Amusco's *Historia de la composicion del cuerpo humano* (1560).

[553] Fracastoro would later trace the cause of the disease in corpuscles that would spread contagion, the "seminaria" ("Quomodo seminaria contagionum ad distans serantur, et in orbem," in Girolamo Fracastoro, *Opera omnia*. Venice: Giunti, 1555). At the corpuscular level, an atomistic perspective prevails; thus, talks about units of matter as Fracastoro's "seminaria" as agents of contagion, coexist with suspected heresies for scientists, Galileo included (Byers, Redondi, Blackwell).

[554] The word 'sprazzo' meant both the gradual dispersion of liquids in tiny drops, and a less intense outbreak ("Spargimento di liquore in minutissime gocciole" in *Crusca*, third edition, volume 3, 1597). The *Crusca* dictionary mentioned an example from historian Varchi: "Onde nacque, che la peste, della quale in loro, che non ne fanno molto caso è sempre qualche sprazzo, si appiccò in Firenze" (vol. 2, book 12, 197 *Storia fiorentina di Benedetto Varchi*, ed. Michele Sartorio, 1846). The word 'sprazzo' was colloquial. When Galileo's friend Maria Tedaldi was waiting to hear the Inquisition verdict, she wrote that there were fewer and fewer cases of plague and used a synonym of sprazzo, namely residuo ('residue'): "più presto un poco di residuo si può addimandare che propriamente male, et hieri pure non andò più che uno al lazzeretto" (28 May 1633; *OG* XV, 138-140). Other words on the plague are found in Florio's Italian-English dictionary lists *contagio, contagione,* and *contagioso* (83), *glandule* = *ghiandole* and * *glanduloso* = *ghiandoso* (151), and *peste, pestilentia,* or *pestilenza* and *pestifero, pestilentiale,* or *pestilentioso* (271-272). Those terms, however, are not present in Galileo's discussion of the plague.

practitioners, and some hypotheses were advanced on the historical origins and comparisons of remedies and their effects and side effects. First, it was argued that people returning to Europe from the Americas might have brought the disease with them. Second, there was an outbreak of a new epidemic disease, later found to be syphilis, in Naples, when French soldiers captured the city in 1495 during the first Italian War. According to Fracastoro and other scholars discussing syphilis, the medical problem seemed to arise elsewhere, and to affect people in Italian territories because foreigners had brought the disease with them.[555] Fracastoro, therefore, seemed to believe that early outbreaks of the disease had coincided with the exploration of the Americas.[556] Additionally, the alignment of Saturn, Mars, and Venus in Scorpio seemed concurrent with the French disease and ominous, though often not necessarily a cause for the disease.[557] As historian Claude Quetel wrote, oftentimes for epidemics the culprit was a foreigner who introduced the infection to another territory. General treatment for syphilis is found in Fracastoro's book, where he recommended a special diet and a modest lifestyle to recover and maintain health. Mercury was the best remedy "[…] of agents that will cure a tainted breast... / Absorbing the fires of this vile leprosy / And all the body's flames by its sheer weight" (Book II). In this mythological fiction, mercury healed a Syrian hunter named Ilceus. Another excellent remedy was the bark of the guaiac tree, also called 'holy wood,' that cured the shepherd Syphilus. The story narrated by Fracastoro became a backstory thanks to the mythological characters and facts that he represented through fiction, in

[555] "Did these men bring to us this latent curse? / Few people has it failed to scarify, / Since commerce introduced it from the west. / Hiding its origin, this evil thing / Sprawls over Europe. / The strangest plague returned to sear the world. / Infecting Europe's breast, the scourge was hurled / From Lybian cities to the Black Sea's wave. / When warring France would march on Italy, / It took her name."

[556] "Till Spanish sailors made west their goal, / And ploughed the seas to find another pole, / Adding to this world a new universe." Claude Quétel had studied ancient and modern theories on the origin of syphilis (Claude Quétel, *History of Syphilis*, Baltimore: John Hopkins University Press, 1992).

[557] "la dispositione dell'aria . . . con quella congiuntione tanto rea, di Saturno, Marte, e Venere nel segno di Scorpione, ci come fu in quel anno [sic]" (Massa, p. 22). Falloppio, however, blamed a negative astral conjunction for syphilis, and believed that astronomy was a topic neglected by doctors "quod illos aspectus debeat medicus observare non credo, potest magis cantaros, et urinales contemplari quam coelum" (Falloppio, 5r).

verses. Fracastoro's fictional account was engraved and printed about two generations later by Johannes Sadeler.

In Sadeler's illustration, we see an elegant woman, possibly a courtesan, playing the lute by a fountain next to a creek. In the center of the illustration, the poet holds a copy of his poem in his left hand, while pointing with his right hand towards the origin of the disease, a statue of Venus and two men on the right. According to art historian Erwin Panofsky, the illustration is allegorical, and the statue of Venus alludes to the sexual origin of the disease. On the right, a man (Syphilus, possibly) drinks water that might be contaminated. The other man, holding a spear, is the Syrian hunter Ilceus, healed from syphilis thanks to mercury.[558] Through the charming woman playing music and the goddess of love Venus right behind her, there are sexual allusions present in the engraving, but Fracastoro had not suggested that syphilis was only venereal.

[558] See Erwin Panofsky, *Homage to Fracastoro in a Germano-Flemish composition of about 1590?* «Nederlands Kunsthistorisch Jaarboek» 12 (1961), pp. 1-31. Three Latin distichs under the illustration, are inspired by passages from the Bible, and those verses should remind viewers of the risks of temptations, as opposed to chastity and wisdom.

Figure 12. Engraving by Jan Sadeler I, after Christoph Schwartz, 1588/1595.
Photo courtesy of the Wellcome Collection. In this illustration, Girolamo Fracastoro holds his book, looks at the characters of his story, Syphilus and Ilceus, and shows a statue of Venus to warn them against syphilis.

Another book on that illness also circulated in Latin and in Italian, as Fracastoro's book did. The *Book on the French Disease* (*Liber de morbo Gallico*, published in Venice in 1536) by Niccolò Massa (1485-1569) became famous because the author was a renowned expert in public health. This tract would often be reprinted and bound with another book Massa had published on the plague, the *Book on Plague Fever, and on Skin Symptoms of Plague*, published four years later.[559] Therefore, comparing similar signs in patients and listing all possible signs seemed a safe and responsible method that Massa had learned from his 1535 public health study, from which readers could benefit. According to Massa, signs of syphilis covered a wide range, including skin sores, problems with vision and breathing, lymphatic swellings, and joint pains.[560] Massa gave a definition of the French disease ("mal Francese") as a "new disease, for us, in which often occur many scabs and other filthy sores on the skin, pain in the limbs, abscesses, bad sores." He added that one or more symptoms could occur at once, or in more occasions.[561] He also referred to all those symptoms in the textual advertising for his patented bandage, "that softens the hard skin ulcers... among the tested remedies against bad sores or the French disease... and removes the pain, solves hard abscesses, heals bad wounds, and completely stops the French disease."[562]

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[559] *Liber de febre pestilentiali, ac de pestichiis, morbillis, variolis, & apostematibus pestilentialibus*.

[560] "[…] tal hora si somigliano alla volatica, & talhora alla scabbia" (Massa, p 15). By an accurate account of signs, he could mention any medical detail he had observed in the general population, though often one or two signs occurred in a patient's experience. Comparing similar signs in patients and across case studies seemed safe and necessary, for doctors.

[561] "Il mal Francese è infermitade a noi nuova, ne la quale spessissime fiate appareno broggie diuerse, & altre immonditie de la pelle de l'humano corpo, dolori ne le membra, aposteme dure, piaghe maligne, & in alcuni ui s'accoppiano tutte queste cose, in alcuni ueramente ò broggie solamente si ueggano, ò immonditie, ò dolori ò aposteme, ò broggie con i dolori, ò dolori con aposteme, ò con piaghe che nascono delle broggie, ouero aposteme" (Niccolò Massa, *Il libro del mal francese*, Giordano Ziletti, 1565, p. 2). See the Latin version, too: Niccolò Massa, *Liber de morbo Gallico*, Venice: Francesco Bindoni, 1536.

[562] "Cerotto che mollifica le labbra dure de le ulcere… è da tenere fra secreti sperimentati contra le piaghe maligne, del mal francese . . . Cerotto che rimoue gli dolori del mal francese, risolue le aposteme dure, risana le ulcere maligne, e libera totalmente dal mal francese" (Massa 291-92).

Massa was aware that giving specific medical information was important, considering that doctors were far from agreeing on signs and remedies for the disease.[563] Novelty was not an excuse and, on the contrary, a reason for caution, so that Massa felt encouraged to study nature with fresh eyes searching for signs to understand such phenomenon. He narrated his clinical experience as clearly as possible, because the disease was contagious and it could affect internal organs in addition to the skin and joints.[564] According to Massa, a cause of contagion was sexual intercourse, as well as physical proximity to air, food, drinks, and clothes with the sick.[565]

Another medical author, Gabriele Falloppio (1523-1562), wrote a book on syphilis, *De morbo Gallico* that was published posthumously in 1574. As a Catholic priest practicing medicine, he thought that "God often punishes our sins with diseases" and the current problems with syphilis derived from moral corruption worldwide.[566] He also disagreed with medical practitioners who believed certain qualities of waters, air, and places to cause syphilis. Falloppio insisted that doctors should not study weather and astrology, instead, they should consider the analysis of urine, and look for both physical and emotional signs in patients.[567] The cause for the disease was sexual contagion, thus, he concluded, people were to blame for contracting syphilis and, consequently, for the ensuing medical and mental issues.

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[563] "[…] non pochi altri dubij sono circa la curatione del mal Francese, liquali [sic] assaissime uolte sono soliti à concitare fra medici molte difficoltà, e molte guerre" (Massa, p. 145).

[564] "[…] a bad constitution for one's liver, tending towards coldness and partly dryness, with an unknown way to affect all body, through veins and pores, furthermore, it is contagious" ("[…] una dispositione cattiua del fegato, declinante a frigidità, & in parte a siccittà [sic], con una occulta qualità, che per le uene, e per le porosità, uiene à communicarsi à tutto il corpo, & è contagiosa" Massa, p. 14)

[565] "[…] è 'l parere di alcuni, che chiunque si troua maculato di tal male, si sia macchiato per il contagio del coito, cosa che è contra la sperienza" (Massa, p. 3). Also, humors and contagious agents would interact in causing syphilis ("tal'hora nasce questa infirmità da intrinseca alteratione, et molto ben spesso dalla estrinseca contagione, laqual si introduce per la exhalatione di cattiui uapori . . . E perche [sic] questa infirmità è materiale, communicata a tutto il corpo . . . uenne ad infranciosarsi" Massa, p. 5).

[566] Falloppio 1r. The book was first published in 1563, one year after Falloppio's death.

[567] "[…] non aquam, non aerem, nec locum, sed actiones hominum, et hae sunt contactus, et confricatio hominum inter se" (Falloppio, 7r-v).

The authoritative anatomist Andreas Vesalius (1514-1564) had also written about syphilis in his *Epistola […] radicis Chymae* (1546), an open letter describing properties of the China root. When Vesalius was the Imperial Doctor, he wrote a letter on the herbal drink derived from the China root that he concocted and used for Emperor Charles V. Though he clearly announced the herbal remedy in the title and frontispiece to the book, Vesalius was quite secretive about the emperor's disease, thus he wrote the book as a letter to a friend and colleague, instead of advertising it as a book on the treatment of syphilis.[568] One of the book's main goals was also a revision of traditional books by Galen, whose theories he criticized.[569] The China root seemed to be very effective as ointments and herbal preparations could be administered frequently, without the terrible side effects caused by mercury. It was, however, an expensive remedy, as guaiac wood was. The integration of genres across treatises, letters, and autobiographical texts is beneficial in terms of comparing factual information on syphilis treatments found in the *Letter on the China Root* by Vesalius and his patient, Charles V, as contrasted to the personal experience of the artist Cellini, in the 1540s and 1550s, and the earlier experience of the poet Cammelli.

By integrating medical narratives and narrative medicine, we can learn more about the reasons, modes, and styles for the medical humanities. From a first-person narrative, views of objectivity and subjectivity ensue, through the eyes of a trained healthcare practitioner, as the witness of a medical case, and through the eyes of a patient who experienced signs at the physical and psychological level and expressed those states of mind and body in words, as we saw from

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[568] The full title is *Andreae Vesalii Epistola, rationem modumque propinandi radicis chymæ [sic] decocti ... pertractans: et praeter alia qvaedam, Epistolæ cuiusdam ad Iacobum Syluium ... [Et Regimento per pigliar l'acqva de la radice de chyna]*. The book, edited by Francis Vesalius, the author's brother, was published in Venice in 1546 by an unknown publisher.

[569] Galen's authority was fundamental in medicine. In addition to textual references to his influential books, the Galen's pervasive presence shows visually in artworks; in a detail of Maarten Heemskerck's painting, "Saint Luke Painting the Virgin" (ca. 1553, Musée des Beaux-Arts, Rennes), Galen's open book is shown as the authoritative source of information for anatomical knowledge (Jacobs 101).

Cellini's autobiography and Galileo's correspondence. Through narrative medicine, both fictional accounts in Fracastoro's medical poem, and factual remedies for syphilis are discussed from medical texts by Massa, Falloppio, and Vesalius, ranging from mercury and guaiac to the China root. Next, we will expand the mosaic of sixteenth-century sources to include artistic narratives such as illustrations, and more personal renditions of the artists' experiences and perceptions.

6. Visual Narratives in Artworks.

As discussed earlier, medical narratives written by non-experts such as Galileo and Cellini presented insights on medical matters and privileged patients' experiences. Artists, too, represented nature and the human body, and their views were influenced by recent anatomical discoveries and the newly established requirement to attend dissections during their training at the Florentine academy. Michelangelo encouraged the practice of artists attending dissections, as we can see in the drawing by Bartolomeo Passarotti, *Michelangelo Conducting an Anatomy Lesson* (1570). Such combined interest of artists and anatomists, discussed by Fredrika Jacobs and by Sachiko Kusukawa in their studies of scientific illustrations, is also seen in the anatomical tables of Vesalius's treatise, etched by Stephan van Calcar, an artist of the School of Titian. The artist represented an anatomy lesson on the frontispiece, in which Vesalius, the author and young professor of medicine, dissects a cadaver.

In 1543, Vesalius published *De humani corporis fabrica* (*On the Structure of the Human Body*). His book became the foundational anatomical atlas for doctors, who could refer to accurate drawings in the anatomical atlas. In the anatomy lesson, the anatomist performs his job as a professor and as an 'ostensor' in the anatomy room, showing what is found in the human body. Although it can be argued that scientific illustrations were printed in technical textbooks, it must also be said that their details soon entered the public sphere through artworks inspired by the same observations and anatomical lessons. Vesalius was aware that his book was innovative because of its contents and illustrations, making it a reference book and an anatomical atlas without parallel. In the opening scientific illustration that is found on the book preface, Vesalius also breaks the fourth wall by staring at his viewers and readers, among a crowd of participants, so that readers

and viewers of his books can replicate the experience of textual and visual spaces to which he invites them with a nudge.[570]

In Vesalius's books, there are representations of skeletons and flayed men, oftentimes with a background of non-human elements of nature.[571] Landscapes, mythological figures, and allegories accompanied the medical text of Vesalius to complete medical facts, thus representing anatomical dissections along with images of natural beauty in scenery and man-made objects. The landscapes in the background of those etchings are oftentimes the countryside around Padua, where Vesalius was a professor of medicine at the time of publishing his *Fabrica*, a book he published in Basel. The etchings are so elaborately constructed, that unfolding lines of the Euganean Hills reveal the same structure as the muscles explained on the same page, and it is technically possible to disassemble the paper folds constituting some of those printed copies.[572] Thus, in a scientific book, macrocosm and microcosm combined at the visual level, in which Vesalius's book combined medical and visual knowledge of the human body, merging textual and artistic representations of body parts and structures, and human understandings of medical themes. The anatomical atlas is also interesting at the level of material culture, as one extant copy of the *Fabrica* records autograph notes by the owner, Philip Melanchthon, the Lutheran humanist and

[570] Bartolomeo Passarotti's drawing is found at the Musée du Louvre, Paris. Michelangelo was known to have an interest in anatomical study and had collaborated with physician Realdo Colombo (Jacobs 11). On Michelangelo and anatomy, see Jacobs' Chapter 3 "(Dis)assembling: Michelangelo and Marsyas" (62-104), in particular Ascanio Condivi's account of his dissection of a Moor (65) and anatomical lessons for artists (86-94). In July of 1563 the Accademia del Disegno in Florence began to require its members attend annual dissections at the hospital of Santa Maria Nuova. See Patricia L. Reilly, "Drawing the Line. Benvenuto Cellini's *On the Principles and Methods of Learning the Art of Drawing* and the Question of Amateur Drawing Education" in *Benvenuto Cellini: Sculptor, Goldsmith, Writer*, eds. M.A. Gallucci and P.L. Rossi. Cambridge: Cambridge University Press, 2004 (26-50; anatomy, 34-35; on anatomical interests for Cellini and his readers; on Vesalius' *De fabrica* and Juan Valverde de Amusco's *Historia de la composicion del cuerpo humano*, adopting virtually all of the images from the *Fabrica*).

[571] On 'écorchés' or flayed men, see Jacobs, *The Living Image* 199-203.

[572] Such interconnectedness of landscapes and human parts is shown at the Rutgers University Libraries special books collections in Newark, NJ. I am very thankful to specialist librarian Bob Vietrogoski who demonstrated that connection on the book's paper to me, and to specialist librarian and digital humanist Francesca Giannetti for helping me with access to dedicated Italian collections at Rutgers University Libraries.

theologian, who wrote a poem on human nature on the flyleaf of his own copy of the book by Vesalius.[573] This attribution to a book owner and his autograph notes demonstrates once more how deeply embedded the Book of Nature metaphor was within scientific and religious domains.

The list of body parts and their functions contributes to an overall understanding of the structure of the body that Vesalius called *fabrica* in his anatomical treatise. In 1543, Vesalius also produced a summarized version of his book, titled *Epitome*, with fugitive flap anatomies. The book became very popular, both for its pedagogical approach and its visual appeal. Flap anatomies are single sheets with superimposed flaps that, when lifted, reveal layer by layer male and female internal organs, represented by Adam and Eve, or a Greek warrior and a chaste Venus whose iconology is known as 'Venus pudica.'[574] Both books by Vesalius were printed in Basel in 1543, after an early edition, *Tabulae anatomicae sex*, had been published in Venice in 1538 by Bernardo Vitale. Unlike the illustration from Petrus da Montagnana discussed in Chapter One, there is no book next to the lecturer in the anatomical lesson. Seeing nature and learning from medical experience seemed sufficient, to Vesalius, to show that Galen was incorrect, at times, because he had likely never performed dissections on humans. The balance between theory and practice was a goal for artists and doctors alike.[575]

[573] Dorothy M. Schullian, "Old Volumes Shake Their Vellum Heads," 413-48.
[574] Jacobs believed that models of anatomy show human bodies as the sum of parts (Jacobs 55-56; 95; 153-59). The use of pedagogical anatomical image of dissections was criticized, though, by Massa. In his introductory book on anatomy and dissection published in Venice in 1536, Niccolò Massa repeated an ancient caveat concerning the efficacy of books of anatomy: "Whoever wishes to see the works of nature should not put faith in anatomical texts but in his own eyes." In Chapter 6, "The Lifeless and the (Re)animation of the Lifelike" (Jacobs 168-98; 190), Jacobs argued that Vesalius assembled parts as a whole, similarly to the work of Bernardino Baldi in *De gli automati* (1601).
[575] Jacobs 6; 66-70.

Figure 13. Frontispiece to Vesalius, *De humani corporis fabrica* (1543).
Courtesy of the National Library of Medicine, Bethesda, MD.

In the illustrations I have examined in this research, artistic intentions are a form of narrative, though not textual. In the frontispiece to Vesalius's book, one can see a narrated lesson of anatomy, in visual forms and details. In medical sources that were textual, the Book of Nature metaphor fostered an exposition of symptoms, remedies, and case studies that admitted many possibilities, and at times left room for future integrations and improvements. For plague and syphilis, I have found a tree-like logical structure that was expandable and flexible to address needs and questions in terms of signs, symptoms, and treatment for scientists and readers alike. In the preface to Vesalius's treatise, an illustration shows the professor in the central position, surrounded by a displayed stage of students and colleagues who gathered to see, learn, and confirm or correct their previous doctrines deriving from Galenic books that Vesalius criticized and proved wrong, for example when he denied the so-called rete mirabile, a retiform plexus at the base of the brain in humans.

The value of such artistic narration shows in scientific illustrations, where closeness to reality is conveyed through medical observations which, in turn, are interpreted and represented by artists. In addition to theories advanced by Jacobs, Kusukawa, and Marr regarding illustrations as important carriers of discipline-specific meaning, it is also true that the formal and experiential aspect of human experiences is represented by the spectators, whose knowledge is represented as a cultural process in progress, as they see a human body explained. The study of nature, though for different purposes, still relied on the concept of analogy between what one sees and what one represents in artworks and scientific illustrations respectively, as Jacobs noted, thus responding to ideals of Aristotelian teleology.[576] Theoretical knowledge needed to be complemented by practical knowledge, in which one can see and learn from experience, a pedagogical insight which is a

[576] In particular, see Jacobs' Chapter 2 "The Analogical Relationship of Art and Life: Concepts and Language," 16-61.

foundation of scientific experimental methods. Through texts and images, the analysis of narrative medicine in the sixteenth century in Italy provides useful tools to understand the history of diseases in the early modern period. Narrative medicine works both as a source of information for the medical history of patients, as a collection of individual experiences and case studies, but also as an interpretive method for the communication that doctors convey. Medical communication in the sixteenth century derived from theories on contagion but, most importantly, from the stories that doctors narrated in their books, which patients had shared with them. When physicians reported a considerable number of experiences, they presented a variety of case studies through narration while also promoting international communication on those topics. Their styles, language(s), and perspectives showed the importance of narrative medicine before an official, sound theories and therapies for plague and syphilis were established. Narrative medicine could, therefore, integrate various viewpoints on the origin and therapy for plague and syphilis, and provide evidence for what was effective and safe.

I will consider another artistic representation: the statue by Bernini representing a personification of Truth. In it, the artist brought together physical dimensions of art and textual layers of abstraction, which display craftmanship, beauty, and spontaneity. This statue shows a systematization achieved in visual science through art, as clearly as Tesauro and Ripa demonstrated for allegories and emblems in textual terms. The visual allegory confirms rhetorical witticisms related to allegories, symbols, emblems, and metaphors in Tesauro's writing recommendations, and a visual marvel to combine in one physical artwork of the Baroque period. The Book of Nature parallels structures of summative knowledge achieved in Vesalius's 'fabrica' which, in turn, advanced from traditional medieval imagery of the zodiac man and the 'homo vulnerarius.' The pulse of veins visible at her wrists was an anatomical detail that, according to

Jacobs, was considered the highest form of realism achievable.[577] When we look at Bernini's statue, features of the Baroque grandiose style appear clear as light distributes on the surface of a woman, barely covered with a cloth, who smiles and holds a solar disk in her right hand in an eternal present. While the symbolism of this statue is unclear and discussions are ongoing, the effect of marvel that poet Marino praised is visible and powerful in its essential message that Bernini as an artist and observer of reality wanted to inspire and marvel viewers through realistic anatomical displays of knowledge.[578]

The words of patients and artists, though, originate from the same humanistic training that physicians had received. In addition to words, visual sources enrich the early modern experience that we can acquire, and visual details are also conveyed through books, letters, and artworks. The language that crosses cultural boundaries among disciplines is, thus, universal. It is the language of nature and science, and it has many styles to express everyday facts, marvels, and the possibilities of the world we inhabit.

[577] Jacobs wrote on realism indicating the pulse controversy and the study of anatomy in Padua to be leading factors in the connections between medicine and scientific illustrations made by artists (114-16).
[578] Jacobs' Chapter 5, "Nosce te ipsum: Narcissus, Mirrors, and Monsters," 133-67 discussed the concept of 'meraviglia' starting from its definition on the Crusca dictionary (1612) as "commozion d'animo" (Jacobs 133-34).

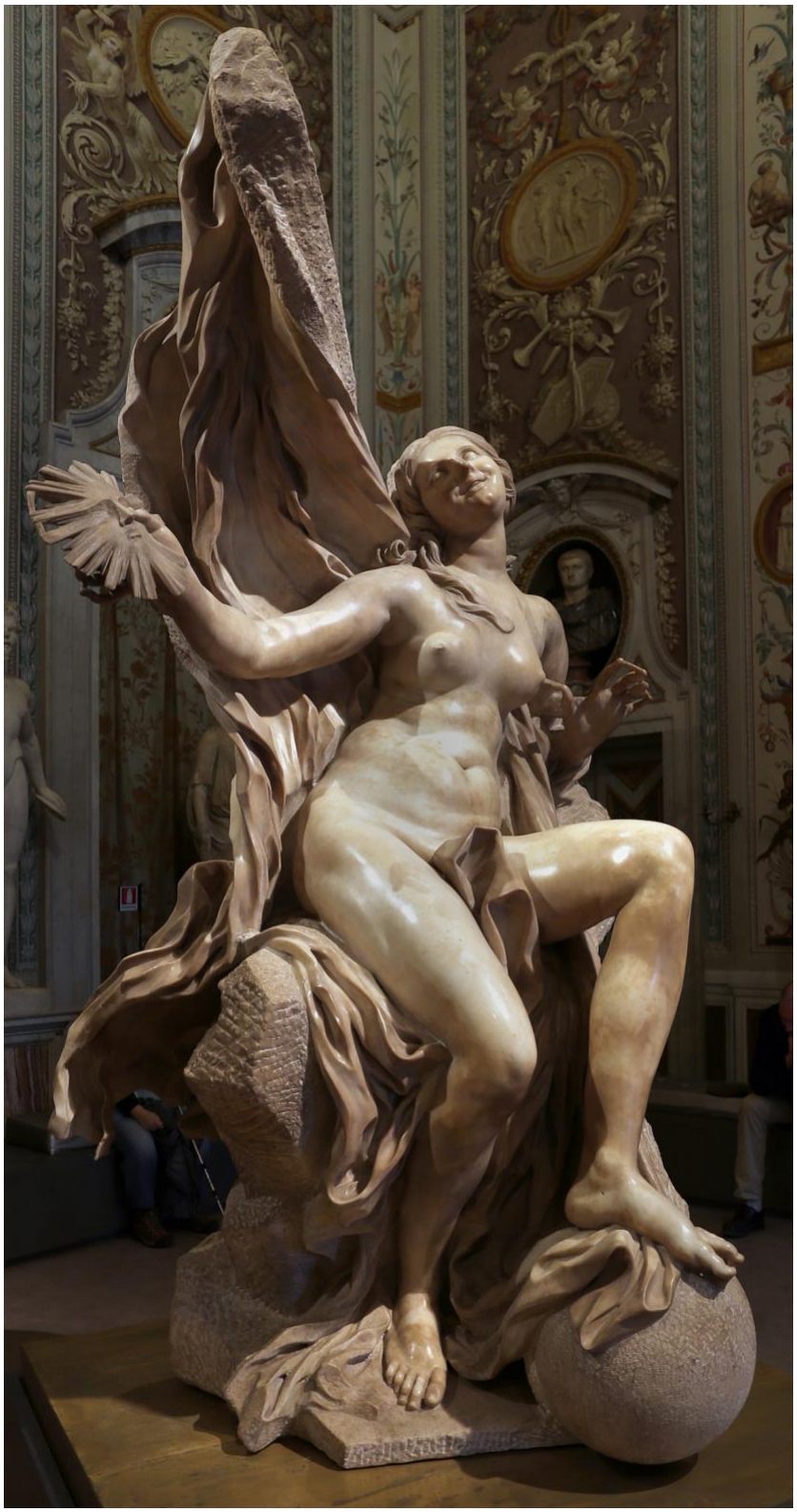

Figure 14. Gian Lorenzo Bernini, *Truth Unveiled by Time*, ca. 1650. Galleria Borghese, Rome. Courtesy of Wikimedia Commons.

Conclusion.

"Scientific Thinking and Narrative Discourse in Early Modern Italy" has explored how scientific writing became a textual and visual genre in the Italian vernacular in the sixteenth and seventeenth centuries. The use of the Italian vernacular acquired strategic meaning in scientific texts published between 1543 and 1633. Galileo and other authors discussed what science is, and how it is best to write about nature and craft scientific methods for each question considered. In addition to printed books, beyond the literary canon, unpublished letters have provided literary and historical evidence that correspondence connected scientists and scholars on a personal and social level, making scientific communication possible in Italy and Europe, in a 'Republic of Letters' emerging as a humanistic network of readers and writers of books.

I have discussed humanistic rhetoric and scientific cultures in the first chapter of my dissertation, "Reading the Metaphor of the Book of Nature," moving from that leading metaphor to connect popular themes discussed at Galileo's times. Chapter Two, "Seeing through Metaphors: Humanistic Words for Scientific Ideas," has examined lexical and cultural innovations inspired by the Book of Nature metaphor across works in prose and verses. In Chapter Three, "Data Persuasion: Quantification and Authority in Scientific Writing," I have analyzed new contents, such as scientific instruments and numbers, in unconventional treatises and coded messages that tackled quantities as meaningful subjects to discuss in writing. Chapter Four, "Complementing Medical Narratives and Narrative Medicine," has explored medical humanities texts in the historical contexts of early modern epidemics syphilis and plague, to include both physicians' and patients' perspectives. Throughout my research, I have also dealt with aspects of the gap between

science and its written representations by non-expert authors leading to a discussion of nature. Besides integrating scientific and humanistic books with archival materials that I studied in Italy and North America, I have also included underrepresented scholars such as women or dissenting intellectuals whose works expressed unorthodox ideas on scientific topics. This study has expanded, I believe, the canon of early modern texts through the topics of science, technology, and patronage. I have examined both books by scientific authors that are now established in the literary canon, and letters, news, and sources found in the libraries and State Archives of Florence, Venice, Padua, along with other epistolary exchanges. Those books and letters have yet to be included in Italian studies, so that it is my call to future action to fill such knowledge gap, expand the reading canon, and promote diversity and inclusion in the fields of Italian studies, the history of science, and medical humanities.

One of the main conclusions of this work is that scientific narratives rely on storytelling modes to share new contents, theories, and ideas. Language matters, and so do narrative modes and techniques to communicate science, and history survives in books across lines that connected the early modern period to the twentieth century and beyond. In 1623, Marino praised Galileo's telescope as instrumental to discovering the Moon's irregular surface (*Adone*, X), one of many astronomical marvels described in the 1610 *Sidereus Nuncius*. In 1984, Primo Levi wrote a poem titled "Sidereus Nuncius" to honor the namesake book by Galileo (Primo Levi, *Ad ora incerta, At an Uncertain Hour*, 1984). Persuaded and fascinated by Galileo's scientific discoveries, Levi wrote that poem as a first-person narrative in which he, a Holocaust survivor, replicated Galileo's historical and scientific work: "I built this spyglass" ("quest'occhiale l'ho costruito io," Line 11). Speaking on behalf of Galileo, Levi described "mountains and valleys" as irregularities he saw on the Moon, through the telescope ("monti e valli," Line 3), and he also imagined "countless legions

of new worlds" rising from the Milky Way ("legioni infinite di mondi nuovi," Line 8). Intellectual connections between Levi and astronomy have been recently reflected in the taxonomy of the natural world that both the scientist Galileo and the chemist Levi studied, and the night sky welcomed a small planet recently discovered between Mars and Jupiter, now named 'Primolevi' in honor of the chemist turned novelist and poet.

Through deliberate literary and scientific reflections in narrative forms, contents such as natural experiences and experiments can be conveyed to an audience who, regardless of their education, might have not experienced those phenomena. Through *Europeana*, the European Union web portal, I have explored digitized library and museum collections from European institutions, and I researched communication modes for digital contents that are meaningful to modern users living in a diverse society (https://www.europeana.eu). Along with my dissertation research, my humanistic and digital experience as a member of the Storytelling Task Force for *Europeana* has enriched my understanding of narrative and visual themes. Styles of communication impact the transmission of digital contents for books and artworks that I can see online, but I might have not seen in person, and I cannot help but ask myself if my sense of wonder, when I see a digital image, resembles the marvel experienced by readers holding scientific books at Galileo's time. Have those readers imagined natural phenomena through words – the same way I imagine a digital object to be a real manuscript, book, or artwork that I can see through a digital image, description, and metadata associated with it? Natural phenomena and experiments could feel more real both for scientists sharing their observations, and for readers learning from books. The language, style, words, and narrative mode to describe natural facts shaped a new scientific genre where the Italian vernacular became the ideal medium to express and communicate scientific ideas to a wide audience.

If digital modes of communication bring a modern cultural revolution, historical considerations on the early modern period, opened by Thomas Kuhn, introduced the concept of scientific 'revolution(s)' that William R. Shea contextualized in terms of intellectual and material innovations in Galileo's works. While Mario Biagioli analyzed Galileo's work in terms of courtly and political networks, Crystal Hall has argued that Galileo's authorial persona is deeply connected to his reading habits and literary receptivity, so that his disputes are expressed in epic tones based on Ariosto's *Orlando Furioso*, a book loved by Galileo. In the immense critical edition of Galileo's works, edited by Favaro in twenty volumes, readers can appreciate the Italian language as a beautiful, flexible, and versatile medium that the scientist could master and control. His literary predilections are visible today in marginal notes he left on books he owned – the works by Ariosto, Tasso, and Petrarca, to name just a few of them. The studies of Galileo's library by Favaro, Camerota, and Hall enhance our perceptions of authorial notes and book history, which in turn opens the path to humanistic, and digital inquiries of what one writes, and what one reads.

Such combinations of readers and their books, and writers and their books mirror the Book of Nature metaphor. Early modern intellectuals who discussed science in their works made the deliberate, courageous choice to express new scientific ideas and current debates through available humanistic tools: current languages, complex rhetorical styles, and the support of mathematics as the interpretive language through logics, arithmetic, and geometry to understand nature. Galileo's readings informed his exquisite sensitivity to languages: Italian, Tuscan, Roman, Venetian, Paduan, and the learned Latin. When scholars were persuasive, they became good writers, but when they taught new concepts in science, they also became good educators.

My historical and literary analysis, complemented with the use of digital humanities tools, have demonstrated literary and scientific texts celebrating scientific discoveries and Galileo's

model prose. From such perspectives, categories of storytelling adapted from Proppian categories will guide my future endeavors in stylometry and natural language processing to integrate my doctoral digital work in quantitative text analysis and mapping visualizations as well. Across primary sources and digital methods, I ran my word vector analysis on Galileo's books, and I needed to adapt Italian contents for machine-reading that was originally designed for English texts. As a result of that interconnected humanistic and digital culture, I wrote and typed my own lexicon of early modern Italian to retrace, select, and communicate featured scientific words and connectives for machine-based readings to occur, that I interpreted. Practical implications resulting from my findings include digital readings of Galileo's corpus, which I assembled from digital repositories, to guide future developments in Italian studies and the digital humanities, towards close and distant readings, by developing literary and critical principles and methods to follow.

By exploring early modern authors' scientific and literary cultures, the Book of Nature metaphor is also mirrored across readers and their books, and writers and their books. By writing in the Italian vernacular, Italian scientists and scholars entered linguistic debates that had started in the fourteenth century in Italy. The so-called 'questione della lingua' could be addressed implicitly, when authors published their books in Italian and adopted a special subset of vocabulary and styles, or explicitly, as Galileo did. As early as 1597, Galileo wrote a letter to his former professor at Pisa, Jacopo Mazzoni, in which he described his support of Copernicus and his intentional use of the Italian language in writing. That letter, intentionally copied and circulated to wide audiences, might be the earliest written proof of Galileo's endorsement of communicating scientific and linguistic topics in ways that were unconventional at his times. A few years later, the first mention of Copernicus appeared subtly in a dialogue that Galileo wrote in the Paduan dialect. In the *Dialogo de Cecco di Ronchitti da Bruzene* (1605), which I examined in Chapter

Two, two peasants discussed astronomy and "someone named Copernicus," or so Galileo imagined could happen when he revealed many astronomical truths through that pamphlet. At a time when Torquato Accetto's *Della dissimulazione onesta* (1641) recommended prudence and secrecy, textual aspects of prose, poetry, truthfulness, and Baroque deceit or 'dissimulazione' also posed a question in terms of style and genre. The analysis of scientific texts in the sixteenth and seventeenth centuries has also shown thematic interconnectedness among experiments and natural facts described in texts and images, and a broad definition of human "states of health" recently showcased at an art exhibition and symposium curated by Veronica White and Laura Giles at Princeton Art Museum in 2019. In our current times, what visual and textual correspondence exists in Baroque communication that Vernon Hyde Minor named "Baroque Visual Rhetoric" in his 2015 namesake book? That line of inquiry is one that I want to pursue in my future studies of scientific texts, secrecy, and Baroque aesthetic and rhetoric.

In my concluding remarks, the interchangeable use of local vernaculars as connected to Latin brings more questions for future inquiries. A poet from the Venetian area, Giuseppe Gagliardi, praised Galileo in the Paduan dialect: "dear, famous, extraordinary lord and master . . . a true expert of mathematics and teacher to scholars at Padua, a mirror of honor to our times."[579] Galileo's language and texts are meant to be open across scientific and humanistic cultures, and any human and scientific language is, thus, appropriate to interact with his discoveries and ideas. As Galileo stated at the end of his fable on the origin of sounds: "I could explain the variety in nature with many other examples, to show how nature can succeed in ways we cannot imagine,

[579] Giuseppe Gagliardi (alias Rovegiò bon Magon dalle Valle de fuora) admired Galileo ("Al me caro, lùstrio, celentissimo e da bon Segnore e Paron / el Segnor Galileo de i Galiliegi, / vero arecoltore delle smatemateghe e sleanzaore / in lo Bo de Pava a gi Scuelari de la so prefission, / spiego d'hanore de la nostra itè" *OG* X, 196-97). Gagliardi's poem, titled "Faelamento de Rovegiò bon Magon dalle Valle de fuora e de Tuogno Regonò dalla Villa de vegian, [sic] sora la nieve dell'anno 1608," described an exceptional snowfall in Padua and the countryside in the Winter of 1608.

unless our senses and experience show that to us, but experience sometimes is not sufficient to compensate for our shortcomings."[580] In this research, I have examined intellectual and linguistic affinities between scientific and humanistic representations of nature by expert and non-expert authors, through narrative elements, both conventional and innovative, in scientific prose, but also poems, artworks, and scientific illustrations by Mannerist and Baroque artists. The early modern period is not far from me, as long as I read about science through the stories of those who wrote and illustrated their study of nature in words, images, and art.

[580] "Io potrei con altri molti essempi spiegar la ricchezza della natura nel produr suoi effetti con maniere inescogitabili da noi, quando il senso e l'esperienza non lo ci mostrasse, la quale anco talvolta non basta a supplire alla nostra incapacità…" (*OG* VI, 287).

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