Alessandro Tassoni and His World: Science and Knowledge in Early Modern Italy

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ABSTRACT

This thesis examines the evolution of cosmology in the first half of the seventeenth century through a case study of the erudite Alessandro Tassoni (1565−1635) and his *Pensieri diversi* (1608−1627), an encylopedia covering scientific, literary, historical, and philosophical topics. Highly successful during the seventeenth century, read even by Galileo Galilei, the *Pensieri diversi* has received little scholarly attention. However, it offers a significant contribution to our understanding of the evolution of early modern cosmology because it was published during the early seventeenth century when profound changes in representations of the structure of the cosmos were occurring. Specifically, it sheds light on scientific debates in the decades immediately preceding Galileo's *Dialogo sopra i due massimi sistemi del mondo* (1632).

With his *Pensieri diversi*, Tassoni facilitated the dissemination of scientific disputes across a wider public of erudite non-specialists by using an easy-to-read question and answer format. Yet, he did not simply reproduce opinions from late medieval thought and contemporaneous cosmological debates but instead offered his own critique.

I analyse three key themes from the *Pensieri diversi* (motion, cosmos and immobility of the Earth). These topics open up more nuanced understanding of those complex issues that, over time, led to epistemological changes in the field of the history of science. In order to point out Tassoni's contribution to the science of early seventeenth century, I set his scientific and philosophical speculations in their historical and sociological context, and I also provide close textual and theoretical analysis of Tassoni's cosmological ideas. Thus, I address, more generally, the relationship between scientific and scholarly culture at the dawn of the Scientific Revolution.

ALESSANDRO TASSONI AND HIS WORLD

SCIENCE AND KNOWLEDGE IN EARLY MODERN ITALY

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For Fabio, of course.

INTRODUCTION

This doctoral thesis focuses on Alessandro Tassoni's natural philosophy with a twofold aim: to reconstruct Tassoni's scientific profile; and to shed new light on the evolution of cosmological thinking in the first half of the seventeenth century and its relationship with learned culture. Tassoni can, indeed, be considered an active participant in the contemporary cosmological debate at the dawn of the Scientific Revolution.

Born in Modena in 1565, the erudite Alessandro Tassoni has been widely celebrated in the field of literary studies; today, he is still mainly recalled as the author of the successful mock-heroic poem *La secchia rapita* (The Rape of the Bucket, 1622). Nevertheless, a brief examination of his biography and the content of his works suggests that this author may also be noteworthy for other aspects of his thinking. Looking at Tassoni's oeuvre, it is clear enough that we face an intellectual wealth that it is not possible to depict exhaustively by referring to Tassoni merely as a literary man; in fact, the subjects Tassoni engaged in cover a whole spectrum that includes philosophy, history, politics, and science.

Tassoni was a man of considerable scholarship; he lived at the d'Este, Savoy, Colonna, and Ludovisi courts and was in contact with some of the most renowned personalities of his time, including natural philosophers as well as writers on a range of scientific and literary topics, such as Antonio Querenghi, Giovanni Ciampoli, and Margherita Sarrocchi, during decades characterised by intense scientific debates and preceding the key changes of the Scientific Revolution.[1] Despite his own education and these personal connections, Tassoni is still little known in historical and philosophical studies.

[1] For a general overview about the 'key changes' of the Scientific Revolution, see at least John Henry, *The Scientific Revolution and the Origins of Modern Science* (London: Macmillan, 1997). On the contested concept of 'scientific revolution', see H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry*, (Chicago: The University of Chicago Press, 1994).

The focus of my research is Tassoni's scientific ideas and the role he played as a communicator of debates and a producer of cosmological doctrines, all of which will be analysed within the context in which they were fashioned and circulated. In point of fact, Tassoni sits among the numerous thinkers who participated in the scientific debates of the early modern era, and this he did almost until his death, which took place in his home town in 1635. His contribution was to enrich these debates with new ideas that stemmed from his attentive analysis of a wide range of sources and from suggestions he derived from his relationship with the most dynamic environments of the time.

My reconstruction of Tassoni's scientific thinking is carried out by drawing on relevant theories from his *Pensieri diversi*,[2] an erudite volume written in a question and answer format, and which Tassoni himself considered to be his masterpiece. As a matter of fact, during the seventeenth century, this book was successful, as attested by the history of its various editions, which began in 1608, the year an incomplete edition came to light, and continued right through to 1676, when ten editions had been published, some of which appeared during Tassoni's lifetime in 1608, 1612, 1613, 1620, 1627.[3]

The first edition of the *Pensieri diversi* (*Parte de' quesiti del Sig. Alessandro Tassoni dati alla luce da Giulian Cassiani, e dedicati agli illustriss[imi] signori Accademici della Crusca*, 1608) is dedicated to the members of the Accademia della Crusca. Although Tassoni declared that he had not authorised its publication, the book already shows, to some extent, features of his work; its 151 questions reappear in the subsequent editions. In the second edition (*Varietà*

[2] Alessandro Tassoni, *Pensieri e scritti preparatori*, ed. by Pietro Puliatti (Modena: Panini, 1986). I always quote from this edition (hereafter *Pensieri*), which is the only modern edition of Tassoni's *Pensieri diversi*, unless otherwise indicated, for example, when the comparison with a specific edition from the sixteenth century is needed for the scope of my discourse.

[3] On the history of the editions of Tassoni's *Pensieri diversi*, see especially P. Puliatti, 'Nota ai testi', in Tassoni, *Pensieri*, pp. 938–96; P. Puliatti, 'Per l'edizione dei "Pensieri" del Tassoni', in *Atti e memorie della Deputazione di Storia Patria per le Antiche Provincie Modenesi* 10, 9 (1974), pp. 169–86; Puliatti, 'Per l'edizione dei "Pensieri" del Tassoni', *Studi seicenteschi*, 17 (1976), 61–93; Luigi Fassò, 'Introduzione', in Alessandro Tassoni, *Opere*, ed. by Luigi Fassò (Milan: Rizzoli & C. Editori, 1942), pp. 41−50.

di pensieri d'Alessandro Tassoni divisa in IX parti nelle quali per via di quesiti con nuovi fondamenti e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere, 1612), the title has been modified, and the number of questions has increased to 232 through various additions, eliminations and amendments. As the title itself shows, this volume is organised into nine books and is introduced by a letter to the reader in which the author explains the reasons why he does not dedicate his book to anyone.[4] This edition was then reprinted in 1613.[5] The 1620 edition shows a further amendment of the title (*Dieci libri di pensieri diversi d'Alessandro Tassoni ne'quali per via di quesiti con nuovi fondamenti, e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere. Aggiundovi nuovamente il decimo libro del paragone de gl'ingegni antichi, moderni, e la confutazione del moto della terra, con altri vari quisiti*). An enlarged edition, with 268 questions, this volume includes the famous question about the immobility of the Earth in the fourth book and a tenth book: 'Paragone degli ingegni antichi e moderni (Comparison between the achievements of the ancient and the moderns)'. The 1627 edition (*Dieci libri di pensieri diversi d'Alessandro Tassoni ne' quali per via di quesiti con nuovi fondamenti, e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere. Aggiundovi nuovamente il decimo libro del paragone de gl'ingegni antichi, moderni, con altri vari quisiti*) is composed of 277 questions.[6] Finally, the edition printed in 1636 (*Dieci libri di pensieri diversi d'Alessandro Tassoni ne' quali per via di quesiti*

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[4] 'A chi legge: perché l'autore non dedichi l'opera' (To the reader. The reason why the author does not dedicate his book to anyone)', in Tassoni, *Pensieri*, pp. 367–71.

[5] Alessandro Tassoni, *Varietà di pensieri d'Alessandro Tassoni divisa in IX parti nelle quali per via di quesiti con nuovi fondamenti e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere* (Modena: Giovanni Maria Verdi (Eredi), 1613).

[6] This edition has been considered the most authoritative one by modern scholars. See Fassò, 'Introduzione', in Tassoni, *Opere*, p. 42 and Puliatti, 'Nota ai testi', in Tassoni, *Pensieri*, pp. 994–96.

con nuovi fondamenti, e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere), despite appearing one year after Tassoni's death, nevertheless reflects Tassoni's preferences.[7]

The publication of different editions of the *Pensieri diversi* during the seventeenth century reveals strong contemporaneous interest in his volume. Praise of the *Pensieri* generally stressed the wealth of knowledge offered by the book, which suggests Tassoni's wide-ranging erudition and his critical mind in collecting together so many different subjects. The first praise of the *Pensieri diversi* came from the German historian Caspar Schoppe in 1628[8] and was followed, over the centuries, by positive comments from other scholars, such as Apostolo Zeno, Giacinto Gimma, Giuliano Cassiani, Giovanni Battista Cereseto, Giosuè Carducci, Luigi Settembrini, Giovanni Mestica, Alessandro D'Ancona and Orazio Bacci, and Giovanni Setti.[9]

By retracing the historiographical representation of Tassoni's work between the seventeenth and twentieth centuries, Pietro Puliatti shed light on its shortcomings.[10] Overall, previous studies on Tassoni have underplayed the complexity of his interests, especially on scientific topics. My project aims to fill this gap in the scholarship on Tassoni; only a brief

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[7] See Puliatti, Ibidem.

[8] Caspar Schoppe, *Pascasii Grosippi. Paradoxa literaria in quibus multa de literis noue contra Ciceronis, Varronis, Quinctiliani, aliorumque literatorum hominum, tam veterum, quam recentiorum, sententiam disputantur. Ad Ferdinandum Henriquez a Riuera* (Milan: Io. Baptista Bidellius, 1628), p. 77.

[9] Apostolo Zeno, [preface to] *Annotazioni sopra il Vocabolario degli Accademici della Crusca. Opera postuma di Alessandro Tassoni modonese, riscontrata con molti testi a penna. Aggiuntavi una lettera intorno a questa ed altre opere del Tassoni* (Venice: Marino Rossetti, 1689), p. 8; Giacinto Gimma, *Idea della storia dell'Italia letterata*, (Naples: Felice Mosca, 1723), p. 641; Giuliano Cassiani, 'Elogio di Alessandro Tassoni', in *Raccolta di elogi e orazioni di genere dimostrativo composte dai professori dell'Università di Modena*, I (Modena: Società Tipografica, 1820), p. 52; Giovanni Battista Cereseto, *Della epopea in Italia considerata in relazione colla storia della civiltà* (Turin: Pomba, 1853), pp. 149–50; Giosuè Carducci, *La secchia rapita e l'Oceano di Alessandro Tassoni* (Florence: Barbèra, 1858), p. 5–11; Luigi Settembrini, *Lezioni di letteratura italiana* (Naples: Stabilimento Tipografico Ghio, 1868), vol. 2, pp. 298–99; Giovanni Mestica, *Gli svolgimenti del pensiero italiano nel Seicento* (Palermo: Tipografia Lo Statuto, 1893), p. 11; Alessandro D'Ancona and Orazio Bacci, *Manuale della letteratura italiana* (Florence: Barbera, 1904), vol. 3, p. 352; Giovanni Setti, 'Tassoni e Montaigne', in *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta, 28 giugno 1908*, ed. by Tommaso Casini and Venceslao Santi (Bologna: A. F. Formiggini, 1908), pp. 227–41.

[10] P. Puliatti, 'Introduzione', in Alessandro Tassoni, *Pensieri e scritti preparatori*, ed. by Pietro Puliatti (Modena: Panini, 1986), pp. III–LXXXVI.

account of this scholarship is presented here because it does not often address the scientific topics that are the focus of my research. In fact, literary historians have naturally privileged the role of the writer in the field of literature, and the portrait of Tassoni that the history of literature has conveyed is that of a writer with a bizarre temperament and a lover of paradox and irony, and also someone who was without doubt controversial and who had a biting retort. He has been portrayed as an eclectic thinker, opposed to any form of literary or philosophical authority, and an advocate of the ideals of freedom and justice.[11] Each of his works has been considered an expression of his lively, multifaceted genius.[12] More broadly, previous scholars have labelled Tassoni's stances as heterodox, odd, or antitraditionalist, and has contributed to strengthening the idea that the best result of Tassoni's production is his poem.[13] As a result, the intellectual profile of Tassoni, which combines poetic traits, linguistic abilities, philosophical curiosity, historical interest, and scientific knowledge, has often remained incomplete.[14]

[11] Tassoni's role in the field of literature was also addressed by Stephanie Neu, see Stephanie Neu, *Alessandro Tassoni (1565–1635): Metamorphosen des Epos* (Frankfurt: Peter Lang, 2012).

[12] See, for example, 'Alessandro Tassoni', in Francesco Zambrini, *Cenni biografici intorno ai letterati illustri italiani, o, brevi memorie di quelli che co' loro scritti illustrarono l'italico idioma. Si parla pure della maggior parte de'novellieri, e de' più grandi scientifici anche scrittori di non troppo buona lingua: de' più valenti istorici della letteratura italiana, e de' principali corruttori del buon gusto* (Faenza: Montanari and Marabini, 1837), p. 241; Robustiano Gironi, 'Vita di Alessandro Tassoni', in *Vita e ritratti di illustri italiani* (Bologna: Tipografia governativa, 1844), pp. 289–96; Giuseppe Zirardini, *L'Italia letteraria ed artistica. Galleria di cento ritratti de' poeti, prosatori, scultori, architetti e musici più illustri con cenni storici* (Paris: Baudry, 1850), pp. 124–28; Paolo Gaddi, 'Intorno alla vita di Alessandro Tassoni. Discorso storico', *Nella solenne inaugurazione del monumento ad Alessandro Tassoni, prose e versi, 26 novembre 1860* (Modena: Vincenzi, 1860), pp. 5–24; Luigi Fassò, *Enciclopedia italiana* (Rome: Treccani, 1937), pp. 317–19; Cesare Mussini, *Scrittori italiani con notizie storiche e letterarie* (Turin: Paravia, 1940), p. 128; Francesco Flora, *Storia della letteratura italiana*, vol. 2: *Il Seicento, il Settecento* (Verona: Mondadori, 1953), pp. 745–55; Enrico M. Fusco, *Scrittori e idee. Dizionario critico della letteratura italiana* (Turin: Società editrice internazionale, 1956), pp. 565–67; Vincenzo Caputo, *Profili letterari* (Pisa: Giardini, 1963), pp. 57–60; Giulio Ferroni, *Storia della letteratura italiana. Dal Cinquecento al Settecento* (Milan: Mondolibri, 2000), pp. 266–67. Many more works could be added to this list; indeed, Tassoni's lively and multifaceted personality is attested by all. Giorgio Boccolari compiled a good bibliography on Tassoni in 1960. Today, this is still a good, although not complete reference work, see Giorgio Boccolari, 'Bibliografia Tassoniana', *Atti e memorie della Deputazione di Storia Patria per le Antiche Provincie Modenesi*, 8, 12 (1960), 241–85.

[13] A detailed historiography of Tassoni's from the seventeenth century to contemporary times can be found in Erika Papagni, 'L'antipetrarchismo nell'opera di Alessandro Tassoni' (Toronto: University of Toronto, 2014), pp. 34–101; the page range is the first chapter of the thesis, the chapter being entitled 'The critical fortune of Alessandro Tassoni'.

[14] Tassoni's intellectual profile was also investigated by Bruno A. Arcudi in his Ph.D. thesis, see Arcudi, *Alessandro Tassoni and his rôle in the intellectual life of the Seicento* (Ph.D. Yale University, 1955).

Notwithstanding, there have been exemplary studies on Tassoni, some of which are found in volumes interested in the local history of Modena, and the following are good examples*:* *Studi e ricerche tassoniane* by Giorgio Rossi (1904),[15] *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta, 28 giugno 1908, a cura di Tommaso Casini e di Venceslao Santi* (1908);[16] *Atti e memorie della deputazione di storia patria per le antiche provincie modenesi* (1960, 1966),[17] and *Studi tassoniani. Atti e memorie del convegno nazionale di studi per il IV centenario della nascita di Alessandro Tassoni* (1966).[18] All of these volumes contain contributions addressing particular aspects of both Tassoni's personality and work, stretching from his handwriting and his interests, to his books and his career, friendships, and fortune. In addition, some articles about Tassoni are found in the volumes of *Studi seicenteschi: rivista annuale* by Carmine Jannaco and Umberto Limentani, and edited by Leo S. Olschki, they focus mainly on Tassoni's philosophical interests, his attitude towards literary and scientific debates, and his writing style.[19]

The recent *Alessandro Tassoni. Poeta, erudito e diplomatico nell'Europa dell'età moderna* (2017), by Maria Cristina Cabani and Duccio Tangiorgi, has gone some way towards further broadening knowledge of Tassoni's ideas. This volume stresses Tassoni's wide range of intellectual interests, especially in his roles as tragedian, commentator of texts, and philologist. Likewise, the conference *Alessandro Tassoni e il poema eroicomico*, which took

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15 Giorgio Rossi, *Studi e ricerche tassoniane* (Bologna: Zanichelli, 1904).

16 *Miscellanea tassoniana di studi storici e letterari: pubblicata nella festa della Fossalta, 28 giugno 1908*, ed. by Tommaso Casini and Venceslao Santi, with a preface by Giovanni Pascoli (Bologna; Modena: A. F. Formiggini, 1908).

17 *Atti e Memorie della Deputazione di Storia Patria per le Antiche Provincie Modenesi*, 12, 8 (1960), 164–324; *Atti e Memorie della Deputazione di Storia Patria per le Antiche Provincie Modenesi*, 1, 10 (1966), 149–57, 247–59, 283–90.

18 *Studi tassoniani: atti e memorie del Convegno nazionale di studi per il 4. centenario della nascita di Alessandro Tassoni: Modena, 6–7 novembre 1965*, ed. by Deputazione di Storia Patria per le Antiche Province Modenesi (Modena: Aedes Muratoriana, 1966).

19 I refer in particular to the following essays: Carmine Jannaco 'Personalità e poetica di Alessandro Tassoni', *Studi secenteschi*, 6 (1965), pp. 55−64; Pietro Puliatti, 'Le letture e i postillati di Tassoni', *Studi secenteschi*, 18 (1977), pp. 3−58; P. Puliatti, 'Alessandro Tassoni e l'uso del latino. A proposito di alcuni inediti', *Studi secenteschi*, 20 (1979), pp. 3−42.

place in Padua 6–7 June 2019,[20] presented primarily Tassoni's contributions as a linguist and as a translator of political works, but it also highlighted to a limited extent his interest in scientific topics, particularly astrology.[21]

Although Tassoni's *Pensieri diversi* was popular in the seventeenth century, critical voices prevailed during the following centuries. Essentially, these considered the *Pensieri diversi* to be a chaotic assemblage of both serious and bizarre questions, but hardly able to convey rigorous knowledge.[22] Despite this criticism, the need to give more attention to Tassoni's natural philosophy as it was presented in the *Pensieri diversi* had already emerged towards the end of the nineteenth century. In 1882, Francesco Pitoni argued that Tassoni, through his own observations and judgment of texts foreshadowed some concepts of modern science and so suggested the importance of considering Tassoni's scientific thinking for a more complete picture of natural philosophy in early modern Europe.[23] Fourteen years later, in 1896, Luigi Ambrosi considered the *Pensieri diversi* to be an exemplar of the status of science in the seventeenth century and emphasised the need to focus more on Tassoni's scientific output, including Tassoni among those who 'breaking down ancient prejudices, had […] cleared the

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[20] Elisabetta Selmi, Francesco Roncen and Stefano Fortin (eds.), *Alessandro Tassoni e il poema eroicomico*, ([Forthcoming] Rome: Argo, 2021).

[21] Giordano Rodda's talk, '"Con poca fortuna sempre in tutte le cose mie". Tassoni tra astrologia e autorappresentazione nei *Pensieri diversi*'.

[22] See, for example, Daniel Georg Morhof, *Polyhistor literarius philosophicus et practicus* (Lübeck: Peter Bockmann, 1714), p. 224; Giuseppe Parini, 'De' principi particolari delle Belle Lettere', in *Opere di Giuseppe Parini pubblicate per cura di Francesco Reina* (Milan: Stamp. e Fond. del Genio Tipografico, 1804), vol. 2, pp. 135–251; Paolo Emiliani-Giudici, *Storia delle belle lettere in Italia* (Florence: Società Editrice Fiorentina, 1844), p. 947; Giuseppe Campori, 'Appunti intorno ad Alessandro Tassoni', *L'indicatore modenese*, 2 (1852), 3–42; Hippolyte Rigault, *Histoire de la querelle des anciens e des modernes* (Paris: Librairie Hachette, 1856), pp. 72–74; Giuseppe Ferrari, *Corso sugli scrittori politici italiani* (Milan: Manini, 1862), p. 423; Vincenzo Ratti, *Alessandro Tassoni. Discorso letto per la distribuzione dei premi agli alunni delle scuole d'Asti addi 18 aprile 1884 da Vincenzo Ratti* (Asti: Scuola Tip. Michelerio, 1884); Olindo Guerrini, 'Alessandro Tassoni (1565–1635)', in *La vita italiana nel Seicento. Conferenze tenute a Firenze nel 1894*, ed. by G. Falorsi et al. (Milan: Treves, 1897), pp. 225–46; Giuseppe Toffanin, *Machiavelli e il 'Tacitismo'. La 'politica storica' al tempo della controriforma* (Padua: Angelo Draghi, 1921), p. 113; Vittorio Turri and Umberto Renda, *Dizionario storico critico della letteratura italiana* (Turin: Paravia, 1944), p. 1044; Arturo Pompeati, *Storia della letteratura italiana*, III (Turin: Utet, 1948), p. 119.

[23] Francesco Pitoni, *Sopra i 'Pensieri diversi' di Alessandro Tassoni* (Livorno: G. Meucci, 1882).

way for the new science'.[24] Antonio Belloni, in his review of Ambrosi's *Sopra i Pensieri diversi di Alessandro Tassoni* fifteen years later, stressed the importance of Ambrosi's suggestion, considering the reconstruction of Tassoni's scientific profile to be invaluable for a more accurate and complete understanding of Tassoni himself.[25] Furthermore, in 1911, Heinrich Neaf discussed Ambrosi's contribution with the intention of underlining the need not to simply praise Tassoni's philosophical and scientific profile, but rather to attempt an analysis of his scientific thinking, considering this in relation to its sources and readership.[26] Subsequently, after another half century, in his review of *Studi tassoniani* (1969), Mario Pieri yet again noted the limited interest of historians of science and philosophy in the *Pensieri diversi*, claiming that their extravagant praise was most likely caused by a superficial reading of Tassoni's book.[27]

However, there have been a few key studies of Tassoni's scientific output. In his *La filosofia naturale di Alessandro Tassoni* (1905), Giovanni Nascimbeni focused especially on the *Pensieri diversi*; he was the first to offer an overview of the theories underlying Tassoni's scientific thinking.[28] Three years later, Nascimbeni's 'Che cosa c'è al centro della terra secondo Plutarco, Dante e Alessandro Tassoni,' considered Tassoni's, Plutarch's and Dante's points of view on the centre of the cosmos and its material composition.[29] In his *Bildung und Wissenschaft in Zeitalter der Renaissance in Italien*, the second volume of his *Geschichte der neusprachlichen wissenschaftlichen Literatur* of 1922, Leonardo Olschki provided a general overview of Tassoni's scientific ideas and Tassoni's role in popularizing scientific

[24] 'abbattendo i pregiudizi antichi avevano sgombrato il cammino alla nuova scienza', in Luigi Ambrosi, *Sopra i 'Pensieri diversi' di Alessandro Tassoni* (Rome: Loescher, 1896), p. 65.
[25] Antonio Belloni, [review of] 'L. Ambrosi, Sopra i Pensieri diversi di Alessandro Tassoni', *Giornale storico della letteratura italiana*, 15 (1897), 483.
[26] Heinrich Neaf, *Due contributi alla storia dei Pensieri di Alessandro Tassoni* (Trieste: Herrmanstorfer, 1911).
[27] Mario Pieri, [review of] 'Studi tassoniani', *Convivium*, 37, 3 (1969), 324–45.
[28] Giovanni Nascimbeni, *La filosofia naturale di Alessandro Tassoni* (Jesi: Tipografia cooperativa editrice, 1905).
[29] G. Nascimbeni, 'Che cosa c'è al centro della terra secondo Plutarco, Dante e Alessandro Tassoni', in *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta*, ed. by Tommaso Casini and Venceslao Santi (Modena: A. F. Formiggini, 1908), pp. 249–65.

knowledge.[30] Within the last decade, Giordano Rodda's *Per un commento 'scientifico' ai 'Pensieri diversi' di Alessandro Tassoni* (2014) has analysed some of Tassoni's *quesiti* about the heavens, the Earth, and the world system to stress the connection between science and literature at the turn of the seventeenth century.[31] Finally, Oreste Trabucco's essay in *Bernardino Telesio and the Natural Sciences in the Renaissance* (2019) addresses Tassoni's meteorological ideas in the context of the debate against the Aristotelian meteorology conducted by Telesio.[32]

Research in the field of the history of science in the last century enables us to take up the *Pensieri diversi* once more and shed some light on its historical significance. Works such as *Studi sull'aristotelismo del Rinascimento* (2003) by Luca Bianchi,[33] which focuses both on major Italian Aristotelians and on lesser known figures of European Aristotelianism, and *Ricerche su Galileo e il primo Seicento* (2004) by Luigi Guerrini,[34] which deals with key moments of the philosophical and scientific debate stressing on the academies, institutions, and on various figures involved with them, show not only more awareness of the complexity of this historical period, but also the need to approach the history of science with a more comphrensive and interdisciplinary focus to include those characters that historiography has never before considered in depth. In addition, today Tassoni finds a place also within books such as *The Invention of Science: A New History of the Scientific Revolution* (2016) by David Wootton,[35] *Tintenfass und Teleskop: Galileo Galilei im Schnittpunkt wissenschaftliche, literarischer und*

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[30] Leonardo Olschki, *Geschichte der neusprachlichen wissenschaftlichen Literatur,* Vol. 2, *Bildung und Wissenschaft in Zeitalter der Renaissance in Italien* (Leipzig: Olschki, 1922), pp. 285–304.
[31] Giordano Rodda, 'Per un commento "scientifico" ai «Pensieri diversi» di Alessandro Tassoni', in *I cantieri dell'italianistica. Ricerca, didattica e organizzazione agli inizi del XXI secolo. Atti del XVII congresso dell'ADI – Associazione degli Italianisti (Roma Sapienza, 18-21 settembre 2013)*, ed. by Beatrice Alfonzetti, Guido Baldassarri, and Franco Tomasi (Roma: ADI editore, 2014).
[32] Oreste Trabucco, 'Telesian controversies on the winds and meteorology', in *Bernardino Telesio and the natural sciences in the Renaissance*, ed, by P. Daniel Omodeo (Leiden: Brill, 2019), pp. 96–115.
[33] Luca Bianchi, *Studi sull'aristotelismo del Rinascimento* (Padua: Il Poligrafo, 2003).
[34] Luigi Guerrini, *Ricerche su Galileo e il primo Seicento* (Rome: Istituti editoriali e poligrafici internazionali, 2004).
[35] David Wootton, *The Invention of Science: A New History of the Scientific Revolution* (London: Lane, 2015), pp. 452–53.

visueller Kulturen im 17. Jahrhundert (2014) by Andrea Albrecht, Giovanna Cordibella, and Volker R. Remmert,[36] and *Evening News: Optics, Astronomy and Journalism in Early Modern Europe* (2014) by Eileen Reeves.[37] In these books the study of the early modern period is considered with regard to how the more recent discoveries were perceived and, thus, it is linked to the relationship between scientific theories and their representations. Wootton focuses on Tassoni's reasoning about the comparison between the achievements of the ancients and moderns, inducing us to reflect about Tassoni's reaction to new scientific discoveries. Francesco Sberlati, in *Tintenfass und Teleskop*,[38] focuses on Tassoni's attitude towards Galileo, and this focus leads us to reflect on points of convergence as well as divergence between Tassoni's and Galileo's approaches to the study of the natural world. Eileen Reeves, by looking at the influence of Galileo's discoveries on Tassoni's production, persuades us further how crucial it is to focus on the intersection between early modern intellectual history and the history of science. More in general, thus, these works argue for the importance of considering the historical, sociological, and political aspects of the revolution that gave rise to modern science.[39]

The scientific debates of the early modern era in which Tassoni took part, indeed, reflect a long process of epistemological change which led to a process of rethinking the dominant categories of the study of nature. By analysing Tassoni and setting his scientific and philosophical speculations in their historical context, this project relies on methodology from the history of ideas, a field first developed by the American historian and philosopher Arthur Oncken Lovejoy in the early 20th century. At the root of this field is the conviction that

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[36] Andrea Albrecht, Giovanna Cordibella, and Volker R. Remmert (eds.), *Tintenfass und Teleskop: Galileo Galilei im Schnittpunkt wissenschaftliche, literarischer und visueller Kulturen im 17. Jahrhundert*, Berlin: De Gruyter, 2014.
[37] Eileen Reeves, *Evening News: Optics, Astronomy and Journalism in Early Modern Europe* (Philadelphia: University of Pennsylvania Press), pp. 120–29.
[38] Francesco Sberlati, 'Lo scienziato savio. Galileo e i letterati', in *Tintenfass und Teleskop*, pp. 185–216.
[39] Ivi.

philosophical concepts and problems have to be located in cultural historical frameworks; that is, 'ideas had to be studied as expressed in the whole field of culture'[40] and so became emblematic of the multi-faceted experiences of particular historical period. Such an approach brings to the fore research themes and figures frequently marginalised by historians. My thesis follows this approach by highlighting a little-studied voice in history of ideas and history of science: Alessandro Tassoni. The scholars whose work especially lies at the root of my research are Eugenio Garin and Paolo Rossi. In particular, I turn to their emphasis on avoiding current categories and disciplinary divisions and pair this approach with close textual and theoretical analysis of Tassoni's cosmological ideas. By so doing, I seek to contribute to 'widening the canon of text deserving close study', a goal noted recently by Anthony Grafton in his analysis of the development of the history of ideas as a discrete field.[41]

I have examined Tassoni's cosmological ideas using the first four books of the *Pensieri diversi* which contain the majority of Tassoni's scientific *quesiti*; the last six books cover principally topics not related with natural philosophy.[42] From the 71 *quesiti* in these books, I have selected 16 that deal with three main topics: motion, the cosmos, and the immobility of the Earth. These *quesiti* can be considered those most representative of Tassoni's contribution to early seventeenth-century scientific thought. More precisely, they allow us to get to the heart of complex issues in natural philosophy, such as the essences of celestial and terrestrial matter, celestial phenomena, and planetary motions – issues which both initiated developments underpinning modern science and are fundamental to understanding Tassoni's position within early modern scientific and cultural debates.

[40] Anthony Grafton, 'The History of Ideas: Precept and Practice, 1950-2000 and Beyond', *Journal of the History of Ideas* 67, no. 1 (2006), p. 7.
[41] A. Grafton, 'The History of Ideas', p. 21.
[42] For the structure of Tassoni's *Pensieri diversi*, see Chapter 2.

To evoke the historical context of the *Pensieri diversi*, my thesis is divided into five chapters. The first two pave the way for the analysis of Tassoni's cosmological theories, which are discussed in the last three chapters; this helps to clarify the full complexity of his cosmological doctrine which draws on so many different sources, both classical and contemporaneous. Chapter 1 outlines the stages of Tassoni's life relevant for his understanding of natural philosophy, especially his travels among Italian universities and academies, as well as Tassoni's social networks, which laid the foundation for his philosophical and scientific orientation. Chapter 2 then discusses formal aspects of the *Pensieri diversi* such as its structure, genre and contents. In Chapters 3, 4, and 5, I explore my three case studies of Tassoni's cosmological thinking. Chapter 3 is devoted to motion, a topic that shows how Tassoni navigated the thornier problems of medieval cosmology and how he supported the innovative proposals of Italian naturalism. Chapter 4 depicts the image of the cosmos painted by Tassoni, showcasing his criticism of Aristotle's natural philosophy and the contemporaneous scepticism about the astronomical novelties that emerged from Galileo's discoveries. Chapter 5 addresses the theme of the Earth's motion to demonstrate Tassoni's difficulty with departing from Aristotelian thinking and his commitment to defending a geostationary world system which results in a blend of Aristotelian and anti-Aristotelian suggestions.

While this detailed study of Tassoni will go some way towards filling gaps in the current knowledge of Tassoni, it more broadly contributes to understanding the first phase of early modern science and its reception. The reconstruction of Tassoni's scientific ideas provides additional context for the debate and controversies that followed Galileo's discoveries. In particular, my thesis sheds further light on the complex intellectual exchanges of the early seventeenth century in which traditional knowledge and new perspectives were strongly intertwined.

CHAPTER 1: ALESSANDRO TASSONI: HIS ROUTES TO NATURAL PHILOSOPHY

This chapter offers an intellectual biography of Tassoni that stresses the origins of Tassoni's interest in natural philosophy.[1] Hence, I place more emphasis on the biographical aspects that contribute to an understanding both of the sources of Tassoni's scientific ideas and the theoretical foundations of his later assumptions with regard to matters of natural philosophy. Tassoni's educational path, his work experience, and his circles of friends and acquaintances are all key factors for comprehending the evolution of his scientific thinking.

In addition, a list of Tassoni's works will be offered to highlight the variety of fields explored within his literary, scientific and philosophical production.

1.1 EDUCATION

Modena, Ferrara, Pisa, Bologna

Alessandro Tassoni's lifetime extends over the period 1565–1635, which coincided with the age that laid the foundations for the advent of the Scientific Revolution. This section aims to

[1] For information about Alessandro Tassoni's life and work, see especially: Giovanni Vittorio Rossi, *Iani Nicii Erithraei Pinacotheca* (Cologne: Iodocus Kalcovius et socios, 1645), pp. 185–88; Lodovico Antonio Muratori, *Vita di Alessandro Tassoni* (Modena: Bartolomeo Soliani, 1739); Girolamo Tiraboschi, *Biblioteca modenese o notizie della vita e delle opere degli scrittori natii degli stati del serenissimo signor duca di Modena* (Modena: Presso la Società Tipografica, 1784), vol. 5, pp. 180–217; Ferdinando Nunziante, *Il conte Alessandro Tassoni ed il Seicento* (Milan: Emilio Quadri editore, 1885); Luigi Fassò, 'Tassoni Alessandro', in *Enciclopedia italiana* (Rome: Treccani, 1937); Nascimbeni, *La filosofia naturale di Alessandro Tassoni*; Andrea Lazzarini, 'Tassoni Alessandro', in *Dizionario biografico degli italiani* (Rome: Istituto della Enciclopedia italiana, 2019) [hereafter cited as DBI]. See also the introduction to Tassoni's works edited by Luigi Fassò: Alessandro Tassoni, *Opere*, pp. 9–70. A noteworthy biography of Tassoni was written in English by Joseph Cooper Walker; see Joseph Cooper Walker, *Memoirs of Alessandro Tassoni, Author of La Secchia Rapita; or, the Rape of the Bucket; Interspersed with Occasional Notices of his Literary Contemporaries, and a General Outline of His Various Works*, ed. by Samuel Walker (London: Longman, Hurst, Rees, Orme, and Brown, 1815).

describe Tassoni's formative years, which reflect his growing interest in contemporaneous scientific debates.

Tassoni began to take an interest in the study of natural philosophy when he visited a number of different Italian universities after having received a classical education based on the study of Greek and Latin literature under the guidance of Lazzaro Labadini in Modena, his home town. It is still not quite clear when and where Tassoni started his intellectual journey. The first, unanimously attested information about Tassoni's education away from Modena concerns his graduation in civil and canon law (*in utroque iure*) from the University of Ferrara in 1585.[2]

It is known that when Tassoni was studying law, he attended lectures given by Cesare Cremonini (1550–1631), a professor of natural philosophy and a tenacious supporter of Aristotle. Cremonini's teaching of Aristotelian philosophy included principles considered to be against Catholic doctrine, such as the eternity of the world and the mortality of the soul, and so caused tensions with the Inquisition.[3] However, Cremonini supported his teaching of these principles by emphasising his role as a professor officially assigned to teach Aristotelian doctrine regardless of personal theological opinions. Evidence of Tassoni's acquaintance with Cesare Cremonini is found in a book written by Tassoni and published in 1613: *La tenda rossa*.[4] In the book, Girolamo Nomisenti, a fictional character, who is playing the role of Alessandro

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[2] See Giorgio Boccolari, 'Il diploma di laurea di Alessandro Tassoni', in *Studi tassoniani. Atti e memorie del convegno nazionale di studi per il IV centenario della nascita di Alessandro Tassoni. Modena 6-7 novembre 1965*, ed. by Deputazione di Storia Patria per le Antiche Province Modenesi (Modena: Aedes muratoriana, 1966), pp. 93–101.

[3] For information on Cesare Cremonini see Charles B. Schmitt, *Cesare Cremonini. Un aristotelico al tempo di Galilei* (Venice: [s.n.], 1980); Ezio Riondato and Antonino Poppi, *Cesare Cremonini. Aspetti del Pensiero e Scritti. Atti del Convegno di studio, Padova, 26-27 febbraio 1999*, 2 vols. (Padua: Accademia Galileiana di Scienze, Lettere ed Arti, 2000).

[4] More information about *La tenda rossa* will be provided in Chapter 2 as a way of explaining Tassoni's philosophical orientation.

Tassoni's servant, refers to the meetings between his master (Tassoni) and Cremonini in Ferrara by saying:

> He knew that he had become acquainted with him in Ferrara and that he had always honoured him by attending his lectures and visiting his house at the time when he [Tassoni] was studying law.[5]

In addition to following Cremonini's teachings, Tassoni followed those of another eminent professor, Francesco Patrizi (1529–1597), who also held a chair at the University of Ferrara.[6] Unlike Cremonini, Patrizi did not hold Aristotle in high esteem and attacked boldly his philosophical system. Tassoni's intellectual development was influenced considerably by both these illustrious professors, especially as far as Tassoni's attitude towards Aristotle was concerned. Their influence on Tassoni's philosophical background is also pointed out by Puliatti.[7] More precisely, Tassoni may have developed his interest in Aristotelian thinking from listening to Cremonini's teachings, whereas his critical attitude towards Aristotle derived most likely from Patrizi's teachings.

A notable indication of the time at which Tassoni started his cultural development after his graduation in 1585, is provided by Tassoni himself: in a letter written in 1602, he claims that he had frequented various academies and Italian universities over a period of 16 years.[8] This information suggests that Tassoni started to travel in 1586. However, when different biographies on Tassoni are consulted, in particular, the two written by Ludovico Muratori and Giovanni Tiraboschi, uncertainties arise with regard to the first city he moved to. From the information about Tassoni's life and education provided by Muratori, which is supported by

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[5] 'Egli sapeva d'averlo conosciuto in Ferrara, e d'averlo sempre onorato frequentando le sue lezioni, e la casa sua, come che allora egli attendesse alle leggi', in Tassoni, *La tenda rossa*, p. 22. This must have happened before 1590 because Cremonini left Ferrara and moved to Padua in that year.
[6] Bibliography on Francesco Patrizi is provided in Chapter 4.
[7] In referring to Tassoni's education, Puliatti mentions the influence of both Cremonini and Patrizi on Tassoni's approach to Aristotelian philosophy as well as the impact of the university professors in Bologna on Tassoni's interest in natural philosophy. See P. Puliatti, 'Introduzione', in Alessandro Tassoni, *Pensieri*, pp. I–LXXXVI.
[8] Cf. Alessandro Tassoni, *Lettere*, ed. by Pietro Puliatti (Rome: Laterza, 1978), vol. 2, pp. 275–76.

Luigi Fassò and Ferdinando Nunziante, we learn that Tassoni started his intellectual journey by moving first to Bologna.[9] In contrast, both Tiraboschi and Giovanni Nascimbeni stated that Pisa was the first city Tassoni moved to.[10]

Tiraboschi's inference is derived principally from a letter sent on 24 November 1628 by Tassoni to Paganino Gaudenzi (1595–1649), who had recently been employed at the University of Pisa (then called the 'Studio Pisano'), as Professor of Humanities (*Humanae Litterae*). In the letter, Tassoni himself refers to his presence at the Studio Pisano in his youth:

> In my youth, I frequented this university [University of Pisa] and I had many friends there, especially Florentines. But the professors as well as most of the scholars from that time have all now passed away.[11]

If many of Tassoni's friends and professors had died by 1628, Tiraboschi reasonably assumes that Tassoni must have been in Pisa long before writing this letter.[12] This letter also informs us that Tassoni was taught by Giovanni Talentoni da Fivizzano (1542–1620) during the time he was at the Studio Pisano:

> But My Lord do not be too familiar with students and maintain the dignity of your position so as not to be scorned by them, as happened in my time with Professor Talentone da Fivizzano, who wanted too much to be a gentleman and a good friend and the students never let him teach.[13]

Any other significant information about the length of time he was in Pisa is missing.

It is also known that Tassoni's philosophical and scientific knowledge was nurtured in Bologna, where his education was significantly marked by the opportunity to engage in debates with distinguished scholars such as Melchiorre Zoppi (1544–1634), Claudio Betti (†1589),

[9] Muratori, p.7; Fassò, in Tassoni, *Opere*, p. 9; Nunziante, p. 25

[10] These scholars claimed that Tassoni moved in Pisa even before his graduation in Ferrara. See Tiraboschi, p. 182; Nascimbeni, *La filosofia naturale*, pp. 4–5.

[11] 'Io ancora fui nella mia gioventù a codesto studio e v'ebbi molti amici e particolarmente fiorentini. Ma i dottori di quel tempo ora sono tutti morti e anche la maggior parte degli scolari.', in Tassoni, *Lettere*, vol. 2, p. 275.

[12] Tiraboschi, p. 182.

[13] 'Ma V. S. non si domestichi molto con gli scolari e mantenghi la gravità magistrale per non esser disprezzato da loro, come al mio tempo interveniva al dottor Talentone da Fivizzano, che voleva far troppo del galantuomo e del buon compagno e gli scolari nol lasciavano mai leggere', in Tassoni, *Lettere*, vol. 2, p. 276.

Camillo Baldi (1547–1634), Federico Pendasio (1525–1603), and Ulisse Aldrovandi (1522–1605). Moreover, it was probably through Pendasio and Aldrovandi that Tassoni was introduced to Antonio Persio (1542–1612) and Ascanio Persio (c. 1554–1610), who were Telesio's pupils and staunch supporters of his theories.[14] Tassoni's scientific speculations, as will be shown, are overtly linked with Telesio's philosophy.

Finally, additional proof of Tassoni's presence in Bologna, at least in 1590, is found in an inscription dedicated to honouring Zoppi in the Archiginnasio where Tassoni's name appears in the list of those who compiled the dedication in December 1590.[15]

To reconstruct the educational path followed by Tassoni in his quest for scientific knowledge, I have cross-referenced prosopographical data about individuals who might have interacted with Tassoni. By considering the careers of these individuals and Tassoni's meetings with them, it was possible to obtain information about Tassoni's journeys and places as well as periods of residence. Because of this information, my reading of Tassoni's itineraries leans toward Tiraboschi's assumption: before moving elsewhere, Tassoni went to Pisa, but only after his graduation from the University of Ferrara. I have come to this conclusion by reflecting upon the following information:[16]

<u>Ferrara:</u>

- Cesare Cremonini taught at the University of Ferrara 1578–89 (he left when he was appointed to a chair at the University of Padua in 1590).
- Francesco Patrizi taught at the University of Ferrara 1577–78 to 1592 (when he moved to Rome).
- Tassoni graduated from the University of Ferrara in 1585.

<u>Pisa:</u>

[14] Nascimbeni, *La filosofia naturale*, p. 8.
[15] Muratori, pp. 7–8; Gian Paolo Brizzi, Andrea Daltri (eds.), *Imago universitatis*, vol. 1, item 964.
[16] For information about the people mentioned, see their entry in DBI; for informationa about Giovanni Talentoni, see Emanuele Gerini, *Memorie storiche d'illustri scrittori e di uomini insigni dell'antica e moderna Lunigiana*, vol. 2 (Sala Bolognese: Arnaldo Forni, 1986), pp. 144–46.

- Giovanni Talentoni da Fivizzano was Professor of Logic at the Studio Pisano 1574–94; however, he also held the chair in medicine for 2 years (1585–87). When he was teaching logic, one of his scholars was Galileo, who was a student at the Studio Pisano 1580–85 (before he was appointed to a chair in mathematics at the same university 1589–92). In 1592, Galileo moved to teach at the University of Padua until 1610.[17]

Bologna:[18]

- Melchiorre Zoppi taught philosophy first at the University of Macerata and then at the University of Bologna. In Bologna this was from 1581 onwards. He taught logic 1581–91 and philosophy 1592–1634.

- Claudio Betti was a professor at the University of Bologna, without interruption, 1545–88, where he died in 1589. He taught logic first, and philosophy later. His career made him well known in academic circles, and he was particularly respected for his commentaries on Aristotle. Tassoni was one of Betti's eminent students.

- Camillo Baldi was another key figure in the Bolognese cultural landscape, spending many years teaching at the University of Bologna. He taught philosophy 1579–86 and 1590–1636. He also taught logic 1576–79 and 1586-90.

- Federico Pendasio moved to Bologna in 1571 where he taught natural philosophy at the university until 1604. One of his scholars was Cremonini, who despite starting to study law at the University of Ferrara, turned his interest to philosophy early on. Before moving to Bologna, Pendasio taught at the University of Padua, where he achieved fame for being one of the most influential Aristotelians of the time.[19] Tassoni himself recalled Pendasio with great enthusiasm: he refers to him as 'uomo venerando e memorando che ha ammirato la nostra età e la futura ne sarà invidiosa' (venerable and memorable man of our times such that he will be envied in the future)[20] and 'nuovo Aristotile' (the new Aristotle).[21]

- Ulisse Aldrovandi, a renowned traveller, was definitely in Bologna 1554–1605 where he first taught logic and later natural philosophy.

[17] For more details about Giovanni Talentoni da Fivizzano, see also Laura Paolino, 'Giovanni Talentoni da Fivizzano e l'incipit del Canzoniere di Petrarca', *Italian Studies*, 75, 1 (2020), 41–54.
[18] David Lines, 'Natural Philosophy in Renaissance Italy', *Early Science and Medicine*, 6, 4 (2001), esp. the Appendix, pp. 313–19.
[19] At the University of Padua Pendasio was involved in a dispute with his colleague Francesco Piccolomini (1523–1607) about the interpretation of Book 3 of Aristotle's *De Anima*. This only ended when Pendasio moved to Bologna. Pendasio's reading of Aristotle was focused particularly on Alexander of Aphrodisias's commentary (especially as far as *De Anima* was concerned), and he was often in disagreement with Averroè. For more information about Federico Pendasio, see Simone De Angelis, 'Pendasio, Federico', in *Encyclopedia of Renaissance Philosophy*, ed. by Marco Sgarbi (Cham: Springer, 2015), pp. 1–4.
[20] Tassoni, *Pensieri*, III, 10, p. 467.
[21] Tassoni, *Pensieri*, IV, 15, p. 503.

From these details, it is possible to make inferences about Tassoni's educational path and so to fill in various gaps. Considering there is no reason to put Tassoni's first move before 1586, there are a few pieces of information that help to establish his most likely itinerary. We know that Tassoni was Talentoni's pupil in Pisa and Betti's pupil in Bologna, and that an inscription attests Tassoni's presence in Bologna in 1590. In addition, Tassoni's letters confirm that he was in Modena, and willing to move back to Bologna sometime between 1591 and 1592.[22] Furthermore, biographies of Tassoni report that in 1594 he was involved in episodes of violence and reckless behaviour in his home town.[23] One final proof of his movements is that he wrote a letter to Alfonso II d'Este in 1595 from Modena.[24] All of this information confirms that at least from 1590 onwards, Tassoni moved between the cities of Bologna and Modena. However, we also know that 1588 was the last year Betti taught in Bologna, so Tassoni must have been there from at least 1588 considering he attended Betti's lectures. Consequently, it is possible to narrow down the timespan of Tassoni's residence in Pisa to 1586–87. This assumption does not conflict with any information reported above; rather, it supports and confirms the information found in the most recent biography of Tassoni written by Andrea Lazzarini, who states: 'Before 1594, and probably already in the eighties [1580s], [Tassoni] attended the University of Pisa and lectures by Giovanni Talentoni, who was from Fivizzano'.[25]

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[22] Cf. Tassoni, *Lettere*, vol. 1, no. 1.
[23] Lazzarini, 'Alessandro Tassoni', DBI.
[24] Cf. Tassoni, *Lettere*, vol. 1, no. 2.
[25] 'Prima del 1594, e forse ancora negli anni Ottanta, frequentò l'Università di Pisa e le lezioni di Giovanni Talentoni da Fivizzano', in Lazzarini, 'Alessandro Tassoni', DBI. Certainly, when considering the last decades of sixteenth-century Pisa, a name immediately comes to mind and, as such, the timespan proposed for Tassoni's length of residence in Pisa could be incorrect. The name I am referring to is Galileo. This is not simply because Galileo was Talentoni's pupil as well (when Talentoni taught logic); it is rather because we know that he lived, studied, and taught at the Studio Pisano before 1592. This, in fact, poses a question with regard to possible encounters between Galileo and Tassoni; curiously, if any took place, Tassoni did not mention them. However, reflecting on this possible meeting results in a further reason to confirm the first assumption that Tassoni was in Pisa between 1586 and 1587. During this period, Galileo was in search of an income, and despite his attempts to obtain an academic position, until this became a reality, he apparently undertook private teaching in Siena and Florence. Consequently, it is more than likely that although they had both frequented the Studio Pisano, Tassoni and Galileo never actually met in Pisa.

The importance of having a complete picture of Tassoni's itinerary is strongly linked with the awareness that a person's cultural environment plays a significant role in shaping his/her mindset and in channelling the reception and transmission of scientific theories. Tassoni would be maturing as he travelled along his educational path, and in his writings he would be adapting to the scientific tendencies, fashions, and ideas representative of a specific place. When reflecting upon the theories supported in his work it would do no harm to bear in mind Tassoni's cultural journey across Italy, because this may help to understand where his interest in certain topics originated.

Important figures such as Patrizi and Cremonini, who may have somehow influenced Tassoni's ideas, have already emerged; however, by means of the analysis of Tassoni's scientific theories presented in Chapters 3, 4, and 5, I will further demonstrate that Tassoni's wide-ranging network of friends and colleagues at universities and academies had a considerable impact on his scientific production. Tassoni probably learned more from his contact with learned men and professors than he himself realised.

1.2 LIFE AT COURT

Rome, Turin, Modena

Tassoni was forced by economic circumstances to move to Rome in 1597.[26] Here, he embraced life at court. Becoming a courtier for a cardinal was considered an honorific position, and also a very agreeable one, so it was not surprising that his friend Antonio Balugola warmly recommended that he take up the opportunity.[27] Balugola's words below were reported by Nunziante in his biography of Tassoni:

[26] Tiraboschi, p. 183; Muratori, p. 8.
[27] Francesco Patrizi, Antonio Querenghi, and Vincenzo Gramigna are rappresentative of the life of erudite gentlemen at court, for more insight, see Lina Bolzoni, 'Il segretario neoplatonico (F. Patrizi, A. Querenghi, V. Gramigna): analisi della corte e delle diverse forme di produzione intellettuale e materiale ad essa collegata', in *La corte e il cortegiano, II: un modello europeo*, ed. by Adriano Prosperi (Rome: Bulzoni, 1980), pp. 133–69.

> Listen to me, I really want to help you […] There are always here in Rome many vacant offices; one only needs to know how to find them. For example, for a gentleman like you, it would be very convenient to be accepted into the court of a cardinal. It is an honorable and agreeable position. Certainly, it is not a way to get rich, but you get to eat well, you are respected, you are free to do your own things and even to focus on literary interests as a lot of people do […] yes, I am sure […] this is the right place for you […] Come to my place tonight; there will be many gentlemen and learned people who honour me with their friendship, and then we will see what to do next.[28]

Tassoni's life at court started in 1599 when he was appointed to the position of secretary to Cardinal Ascanio Colonna. In 1600, Tassoni followed the cardinal to Spain, and except for a few short return trips to Italy, he stayed in Spain in the service of the cardinal until 1603. It is very likely that during this period Tassoni made his aversion to Spanish politics quite clear.[29] His relationship with Cardinal Colonna did not last, and he was dismissed in 1604 not long after his return to Rome to manage the cardinal's property.[30]

Despite having to fulfil occasional commitments in his role as secretary to Cardinal Bartolomeo Cesi, which lasted from 1607 to 1621, Tassoni's second attempt to find a stable position as a courtier dates to about 1612. At this point in time, he turned his attention to the court of Duke Charles Emmanuel I of Savoy. It is likely that Tassoni's interest in the court at Turin was the reason behind his refusal to work as secretary to Cardinal Alessandro d'Este.[31]

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[28] 'Mi stia a sentire, ch'io voglio veramente far qualche cosa per lei […] Qui a Roma vi son sempre molte cariche vacanti, il tutto sta a saperle trovare. Ecco, per esempio, per lei che è un gentiluomo converrebbe assai d'essere ammesso nella Corte di qualche Cardinale. È una carica onorifica e comoda. Certo non c'è da arricchirsi, ma si mangia bene, si è rispettati, si è liberi d'occuparsi delle proprie faccende e magari anche di letteratura come hanno fatto molti… sì sì non c'è che dire… questo è il posto che fa per lei… venga da me questa sera, ci saranno varii gentiluomini e letterati che mi onorano della loro amicizia, e si provvederà al da fare.', in Nunziante, *Il conte Alessandro Tassoni*, p. 58.

[29] His aversion to Spain finds expression in some works that are attributed to him, for example, *Filippiche*, *esequie della riputazione di Spagna*, and *Risposta al Soccino Genovese*; for more information on these works see Section 1.4 of this chapter.

[30] This information does not appear in the biography written by Muratori, who claims not to know the reason Tassoni left his position: Muratori, pp. 11–12. More information about the period when Tassoni was working for Cardinal Colonna can be found in Venceslao Santi, 'Alessandro Tassoni e il cardinal Ascanio Colonna', *Atti e Memorie della R. Deputazione di Storia Patria per le Antiche Provincie Modenesi*, 2, 5 (1903), 197–210; Fiorella Sacchiero Parri, *Lettere e minute inedite di Alessandro Tassoni 1600-1604* (Lugano: Tipografia ETF, 1997).

[31] Tiraboschi, p. 191; Muratori, pp. 12−13.

The Savoy court was renowned for its cultural interests, and it is not surprising that to belong here appeared very advantageous to men of letters. In addition, Tassoni held the duke in high esteem: Charles Emmanuel of Savoy, already allied with France against Spain (Treaty of Bruzolo, April 1610), was considered by Tassoni to be the only Italian ruler who could free Italy from Spanish domination.[32] Tassoni's first contact with the court at Turin in 1613 saw him take on the role of political informer through his correspondence with Count Carlo Costa of Polonghera and Count Cesare Alessandro Scaglia of Verrua, both ambassadors to the papal court from Savoy.[33]

These were the years of the First War of the Montferrat Succession (1613–17), when the House of Savoy was engaged in conflict with the House of Gonzaga (Spanish-loyal) for jurisdiction over the Marquisate of Monferrato, which had been assigned to the court of Mantua (House of Gonzaga) since 1536. In 1612, Duke Charles Emanuel I of Savoy, claiming dynastic reasons, occupied Monferrato, unleashing the armed reaction of Spain and, consequently, waging a war whose first phase ended in 1617 with the House of Savoy's defeat.[34] In 1612, Tassoni published a book entitled *Filippiche*, a work that Alessandro Scaglia commissioned him to write at the request of the Duke of Savoy and in which he criticised the Spain and defended the House of Savoy.[35] Paradoxically, Tassoni's strong opposition to Spain would compromise his relationship with the court at Turin shortly afterwards. However, this was not before he was given the position of ordinary gentleman (*gentiluomo ordinario*) to the duke's son, Cardinal Maurizio, in 1618. Then, in 1620, the same year that Tassoni was waiting to be promoted to the position of secretary to Cardinal Maurizio, the duke's second son, Prince Philip

[32] Muratori, p. 13.
[33] For a detailed account of the Duchy of Savoy, see Toby Osborne, *Dynasty and Diplomacy in the Court of Savoy: Political Culture and the Thirty Years' War* (Cambridge: Cambridge University Press, 2002); this is a major study of the Duchy of Savoy offering insight into the diplomatic culture of seventeenth-century Europe, with a special focus on the career of the ambassador Alessandro Scaglia (1592–1641), who is emblematic of the network of princes, diplomats, courtiers, and artists at the point of contact between dynasticism, high politics, and the arts.
[34] Pierpaolo Merlin and Frédéric Ieva, *Monferrato1613: la vigilia di una crisi europea* (Rome: Viella, 2016).
[35] Osborne, pp. 21–29. For more information about the *Filippiche*, see Section 1.4.

of Savoy, arrived in Turin. The prince wanted a reconciliation between the House of Savoy and Spain; therefore, it was not politically wise to keep Tassoni in the service of the court because he was regarded as a threat to the negotiations with Spain. This explains why the anticipated position never became his despite both Tassoni's own expectations and his friendship with Carlo Costa of Polonghera and Alessandro Scaglia.[36]

Under these somewhat unpleasant circumstances, Tassoni decided to spend a period of time at Staffarda Abbey (close to Saluzzo in north-west Italy), one of three abbeys received in custody (*in commendam*) by Alessandro Scaglia from his father. He stayed there for two months.

In 1621, following the death of Pope Paul V, Tassoni was ordered by the Duke of Savoy to attend the papal conclave in Rome with Cardinal Maurizio. Rather than a small sign of reconciliation, the Duke of Savoy's order was more likely a good opportunity for the House of Savoy to ease Tassoni out of the court.[37] However, neither Tassoni nor the cardinal actually took part in the conclave, which ended with the election of Cardinal Alessandro Ludovisi to the papacy as Pope Gregory XV. Tassoni's association with the House of Savoy was close to its disappointing and definitive end.[38] Not even his good reputation with the French ambassador could assist him in being appointed secretary to Cardinal Maurizio, who had been declared protector of France in Rome.[39]

Once back in Turin, Tassoni's hopes of obtaining a position remained unfulfilled yet again; in fact, the reconciliation between the House of Savoy and Spain was decisive for Tassoni's career. Cardinal Maurizio was determined not to let Tassoni enter the court again,

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[36] Muratori, pp. 14–21,
[37] Tiraboschi, p. 193; Osborne, pp. 185–86.
[38] More information about the court of Savoy and the events involving not only Alessandro Scaglia but Alessandro Tassoni as well, see Osborne, pp. 50–87.
[39] Muratori, pp. 19–20.

and he even put obstacles in the way of him staying in Rome.[40] Tassoni, however, entered the service of another cardinal in 1626, when he accepted a position working for Cardinal Ludovico Ludovisi, the nephew of Pope Gregory XV. This was a role he retained until the cardinal's death in 1632.

The last years of Tassoni's life were spent in Modena at the court of Duke Francesco I as a learned man (*gentiluomo di belle lettere*) and as the duke's personal adviser.[41] Albeit uninspiring for Tassoni, being a courtier contributed to building the image of this seventeenth-century Italian learned man that still holds good today and who is described in glowing terms by Muratori:

> among the courtiers in Rome, where he mostly lived, he was a remarkable man in his day, of exceptional intelligence and judgement; an honest man, an eloquent orator, both serious and witty according to the circumstances; expert in many arts as well as in science, that is, endowed with qualities that rarely belong to people who decide to serve noble lords in their courts.[42]

1.3 INTELLECTUAL CIRCLES AND FRIENDSHIPS

Florence, Padua, Rome

Although Tassoni's experience as a courtier was in itself disappointing, it gave him the opportunity to live in Rome and to meet people from a stimulating intellectual environment who contributed greatly to feeding his intellectual curiosity. There is no doubt that Tassoni's cultural interests, which had already led to his appointment as a member of the Accademia

[40] In 1623, soon after Maffeo Barberini became the new Pope (Urban VIII), Cardinal Maurizio accused Tassoni of going behind his back by reporting information from astrological predictions that discredited him. As a result, the cardinal insisted that Tassoni leave Rome for a short time; on this episode, see, for example, Tiraboschi, p. 194. Information on Tassoni's experiences at the House of Savoy can be also obtained through an invaluable work written by Tassoni himself in 1627, but published for the first time only in 1856: *Manifesto di Alessandro Tassoni intorno le relazioni passate tra esso e i Principi di Savoia*. See Alessandro Tassoni, *Il manifesto intorno le Relazioni passate tra esso e i principi di Savoia: commento storico di Roberto Bergadani*, ed. by Roberto Bergadani (Turin: Tip. E. Marietti, 1906).

[41] Muratori, p. 22; Tirabochi, p. 194. For more details on Tassoni courtier, see also Nunziante, pp. 162−178.

[42] 'personaggio, che fra i Cortigiani in Roma, dove per lo più abitò, fece gran figura a' suoi dì, perché provveduto di Ingegno e senno non volgare; Uomo franco, bel parlatore, faceto e serio, quando voleva o lo richiedevano gli affari; ornato di molte Arti e Scienze, cioè di un capitale che rade volte si unisce in chi si mette nelle corti al servigio dei gran Signori.', in Muratori, p. 23.

della Crusca in Florence in 1589,[43] found fertile ground for development. In terms of intellectual stimuli, especially with regard to the scientific debates, Tassoni was able to draw on academies and intellectual circles and take all he could from both. He also had personal friendships he could rely on to encourage him further.

The focus of this section is the study of those figures who, more or less explicitly, could have been Tassoni's intellectual interlocutors in these scientific debates.

During the first years of the seventeenth century, Tassoni had the opportunity to meet prominent figures who were aware of recent scientific investigations which were calling into question the current comprehension of the world. I refer to people well informed about the current scientific debates who were in touch with Galileo personally, and often either directly involved in matters concerning the evolution of the field of natural philosophy, or from intellectual circles in which the cosmological debates were of particular importance. Meetings between Tassoni and these figures were often facilitated by his involvement in matters concerning the papal court. People such as Paolo Coccapani (1584–1650), Virginio Cesarini (1595–1624), Lorenzo Pignoria (1571–1631), Paolo Gualdo (1555–1621), Paolo Teggia (1535–1620), Antonio Querenghi (1546–1633), Giovanni Ciampoli (1589–1643), and Maffeo Barberini (1568–1644), the future Pope Urban VIII, were, among others, all engaged with the Roman Curia, and with whom Tassoni had the privilege of interacting.

In particular, Tassoni established a close relationship with Antonio Querenghi, a man of letters who moved permanently to Rome from Padua in 1605.[44] Querenghi was one of the most prominent and esteemed figures within the cultural circles of his own city, and along with Pignoria and Gualdo was a frequent visitor to Gian Vincenzo Pinelli's house, where cultural

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43 Tassoni's biographies report that he never attended any meetings at this academy, see Lazzarini, 'Alessandro Tassoni', DBI.

44 A major work about Antonio Querenghi in which relevant information about his cultural activities and friendships is found is Uberto Motta, *Antonio Querenghi (1546–1633). Un letterato padovano nella Roma del tardo Rinascimento* (Milan: Vita e pensiero, 1997).

meetings for the educated elite from all over Europe were held. Without doubt, the scientific knowledge Querenghi amassed was linked to his connection with Pinelli. In fact, the latter was directly interested in scientific topics and extremely focused on the recent achievements in the field of astronomy, especially with regard to Tycho Brahe's instruments and works. Because of this interest, Pinelli hoped an intellectual meeting between Galileo and Brahe might take place; however, he hoped in vain. Nonetheless, lively debates about astronomical questions took place frequently at his home, and here, Querenghi, Gualdo, and Pignoria had the chance to get to know Galileo, who was often hosted by Pinelli. After Pinelli's death in 1601, the cultural circles gathered around him found a meeting place at Querenghi's house instead, where he often hosted people from Venice such as as Nicolò and Andrea Morosini, Paolo Sarpi, and Nicolò Contarini. Among the erudite men with whom Querenghi formed a close bond of friendship were Paolo Beni, Torquato Tasso, Jacopo Mazzoni, and Francesco Patrizi, all of whom were prominent personalities in the literary and scientific entourage.[45]

Without doubt, the well-known freedom of expression (*libertas philosophandi*), which was typical of the Paduan environment and very much embraced by Querenghi, promoted debates that departed from strict adherence to Aristotelian philosophy. The topics at the core of Galileo's lectures at the University of Padua were often debated during the cultural gatherings at Querenghi's home, and Galileo himself felt free to discuss his burgeoning cosmological ideas. It is no coincidence that Querenghi figures as the dedicatee of the Galilean pamphlet entitled *Dialogo de Cecco di Ronchitti da Bruzene in prepuosito de la stella nuova.*

[45] For more information about Pinelli and his scientific interests, see Massimo Bucciantini, *Galileo e Keplero: Filosofia, cosmologia e teologia nell'età della Controriforma* (Turin: G. Einaudi, 2003), pp. 23–48; this is Chapter 2 of the book, which focuses specifically on Pinelli, Brahe, and Galileo. However, the book in itself is an invaluable source of information about the human and intellectual facts that led to the development of a new constitution of the universe.

This work originated as a reply to the *Discorso intorno alla nuova stella*, which was written by Antonio Lorenzini da Montepulciano and published in 1605.[46]

Lorenzini was a fervent Aristotelian, and his text was a reaction against the interpretation provided by Galileo of the star that had appeared in 1604 during the time he was teaching at the University of Padua.[47] At that point, Galileo had not yet published anything that challenged the traditional cosmological order; however, because Lorenzini was the first to challenge the innovative interpretation of the star, it was inevitable he would elicit a reaction. Consequently, by using a pseudonym, it was possible for Galileo to disseminate new cosmological ideas. It is likely that Girolamo Spinelli, Querenghi, and probably Benedetto Castelli as well were also involved in ridiculing Lorenzini's views in this way. More precisely, the good reputation Querenghi enjoyed in Padua masked the criticism of Aristotelian philosophy and kept the authors anonymous while hinting at the cultural environment from which the reply came.[48] This brief sketch depicts a scenario in which traditional knowledge seemed to regard the potential for epistemological change as mere fiction. Nevertheless, the crisis that characterised the traditional culture at the turn of the seventeenth century also had more concrete results; for example, it was behind the foundation of the Accademia dei Lincei in Rome by Federico Cesi, Francesco Stelluti, Anastasio de Filiis, and Johannes van Heeck.[49]

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[46] See Matteo Cosci, 'Astronomia pavana nel Dialogo de Cecco di Ronchitti da Bruzen in perpuosito de la stella nuova tra commedia, satira, disputatio accademica e poesia', in *Generi dell'aristotelismo volgare nel Rinascimento*, ed. by Marco Sgarbi (Padua: CLEUP, 2018), pp. 125–87.

[47] For more information about Galileo's interpretation of the 1604 star, see M. Cosci, 'Le fonti di Galileo Galilei per le Lezioni e studi sulla stella nuova del 1604', *Archives internationales d'histoire des sciences*, 68, 180–181 (2018), 6–70.

[48] For more details on this topic, see Umberto Motta, 'Querenghi e Galileo: l'ipotesi copernicana nelle immagini di un umanista', *Aevum*, 67, 3 (1993), pp. 595–616.

[49] On the Accademia dei Lincei, see Giuseppe Gabrieli, Contributi alla storia della Accademia dei Lincei, 2 vols. (Rome: Accademia Nazionale dei Lincei, 1989); Saverio Ricci, 'I Lincei. L'invenzione della mediazione accademica. Nuova scienza, religione, vita civile', in *Sciences et religions, de Copernic à Galilée (1540–1610). Actes du colloque international organisé par l'École française de Rome, en collaboration avec l'École nationale des chartes et l'Istituto italiano per gli studi filosofici, avec la participation de l'Università di Napoli 'Federico II', Rome 12–14 décembre 1996* (Rome: École française de Rome, 1999), pp. 205−34; David Freedberg, *The Eye of the Lynx: Galileo, His Friends and the Beginnings of Modern Natural History* (Chicago: The University of Chicago Press, 2002; Antonio Allegra and Carlo Vinti, *Federico Cesi e il suo tempo* (Assisi: Edizioni Porziuncola, 2005).

The Accademia dei Lincei fashioned itself as a free study association established in 1603 with the aim of promoting the dissemination of knowledge in a way that was different from the traditional teaching methods dominant at the universities: Aristotle's natural philosophy and metaphysics, Ptolemy's astronomy, and Galen's medicine were backbones of university teaching. This, of course, does not mean that the universities were outmoded institutions while academies were avid promoters and advocates of novelties: the contradiction between "old" and "new" is nowadays a dated approach for the studies in early modern science. Both in universities and in academies, in fact, a variety of positions were in force, as become clear when considering the attitude towards the *auctoritates*. As Eva del Soldato puts it 'during the early modern era, ancient authorities were therefore pulled in a constant tug-of-war, at times portrayed more in terms of rhetoric than of their ideas, yet with full awareness of their vital centrality for intellectual debates.'[50] Nonetheless, there is no doubt that the members of the academy were open to new ideas. Galileo, who became a member of the academy in 1611, contributed to defining the profile of this association, in which he found credible interlocutors and fervent supporters. Understandably, the cultural activities of the academy were regarded with suspicion, and following the scientific discoveries of the seventeenth century, it became particularly exposed to the restrictions imposed by the Church, especially because it was a place of encounters and interaction between different fields of research, cosmology included. Therefore, it is not surprising that during the first stage of the disputes concerning Copernicanism, Cesi maintained and recommended an attitude of caution with regard to the dissemination of the new discoveries and their interpretation; in fact, both the academy and Galileo were interested in maintaining a good relationship with the Jesuits.[51] It is probably because the academy continued to support Galileo after he was ordered to desist from holding,

[50] Eva Del Soldato, *Early Modern Aristotle: On the making and unmaking of Authority*, Pennsylvania: University of Pennsylvania Press, 2020, p. 3.
[51] S. Ricci, 'I Lincei', pp. 205–34.

teaching, or defending heliocentric ideas in 1616 that it lost some members: Linceans Luca Valerio and Margherita Sarrocchi are cases in point.[52] Luca Valerio (1553–1618) was one of the most talented mathematicians of the late sixteenth century. He had been a scholar of Clavius, and he himself taught mathematics to Margherita Sarrocchi (1560–1617).[53] Sarrocchi was a poet with wide interests and considerable erudition in the fields of both literature and science and can be considered a knowledge broker because of her relationships with the most powerful intellectuals in Rome, including figures associated with the Roman Curia. Sarrocchi's astronomical interests and knowledge took second place to her creative writing skills in her heroic poem *Scanderbeide* (1606, 1623), which she brought to Galileo's attention, as attested by their correspondence. In fact, she was in touch with Galileo personally, and was his supporter until at least 1613.[54] It could even be the case that she influenced Valerio, who became her life-long friend, to distance himself from the academy once the Copernican controversy became particularly intense.

Indeed, Sarrocchi embraced a geocentric view of the cosmos, but there is reason to believe that Valerio wished to try and resign his membership quite apart from his friend's influence. He was held in the highest regard by the Aldobrandini family, including Ippolito Aldobrandini (Pope Clement VIII), and by Clavius, and he was able to use the influence of this association to gain employment at the Sapienza University of Rome; furthermore, it seems he had never adhered to the Galilean idea of separating physics and metaphysics; therefore, he is representative of a rather more traditional point of view in the matter.[55]

[52] For information about Sarrocchi and her friendship with Valerio and Galileo, see Meredith K. Ray, *Margherita Sarrocchi's Letters to Galileo: Astronomy, Astrology and Poetics in Seventeenth-Century Italy* (New York: Palgrave Macmillan, 2016).
[53] Ray, *Margherita Sarrocchi's Letters to Galileo*, p. 16.
[54] Ray, *Margherita Sarrocchi's Letters to Galileo*, especially pp. 67−80 which report the translation of Margherita Sarrocchi and Galileo's correspondence.
[55] Ray, *Margherita Sarrocchi's Letters to Galileo*, pp. 16−24.

Whether Tassoni was a member of the Accademia dei Lincei has been a matter for debate.[56] What is certain is that he interacted with some of its members and also that he was in Rome during some of the decisive moments in the events involving Galileo, the Jesuits, and the Roman Curia.

Tassoni was, in fact, a member of the Accademia degli Umoristi (and its principal between 1606 and 1607). This was a learned society in which the strong relationship between literary and scientific interests was particularly evident. Founded in 1600 by Paolo Mancini, his wife Vittoria Capocci, and Gaspare Salviani, the academy was also promoted by Cardinal Francesco Barberini.[57]

Margherita Sarrocchi was an eminent member of the Accademia degli Umoristi too, at least until 1608 when she left the society because of literary divergences. As a member she interacted with literary men such as Giovan Battista Marino, Giovan Battista Guarini, and Tassoni himself.[58] The academy also counted among its members the already mentioned Giovanni Ciampoli, Virgilio Cesarini, and Antonio Querenghi, as well as Albertino Barisoni, and Cassiano dal Pozzo, all figures linked with Tassoni in some way. When Querenghi joined the academy in 1611, the friendship between him and Tassoni was, without doubt, reinforced, and between 1614 and 1615 Querenghi even became Tassoni's adviser.[59] It was probably

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[56] Tassoni's membership in the Accademia dei Lincei is still arguable. For example, it is denied in Erminia Guerzoni, *Alessandro Tassoni. Studio biografico-critico* (Palermo: Tip. Fratelli Vena, 1911); however, already in the seventeenth century, the question of Tassoni's membership was debated. For more information about a dispute between Giovanni Bianchi, who denied that Tassoni was a Lincean, and Domenico Vandelli, who conversely claimed for Tassoni's membership in the Accademia dei Lincei, see Michele Maylender, *Storia delle Accademie d'Italia*, ed. by L. Cappelli, vol. 3 (Cappelli: editore Bologna, 1929), pp. 470–71. This book provides a general overview of the academies in Italy: *Storia delle Accademie d'Italia*, ed. by Michele Maylender, 5 vols. (Bologna: Cappelli, 1926–30).

[57] L. Muratori, *Raccolta delle opere minori di Ludovico Antonio Muratori* (Napoli: Alfano, 1762), vol. 18, p. 12. A new study on the seventeenth century academies in Rome is the following book: Maurizio Campanelli *Le Accademie a Roma nel Seicento* (Roma: Edizioni di storia e letteratura, 2020); for information about the Accademia degli Umoristi, see pp. 27−42.

[58] Ray, *Margherita Sarrocchi's Letters to Galileo*, p. 17.

[59] The letters written by Tassoni to his main interlocutor in Modena, Annibale Sassi, confirm his relationship with Querenghi, who, indeed, is mentioned in many letters written in 1616. For information about Tassoni's friendship with Sassi, see Venceslao Santi, *Il fedelissimo amico di Alessandro Tassoni* (Modena: Società tipografica, 1926).

Querenghi who introduced Tassoni to Barisoni. The relationship between Barisoni and Tassoni is also attested by the letters sent by Tassoni to Barisoni (in one of them Tassoni asks Barisoni for a telescope for one of his friends). Even though Barisoni's collection of letters did not survive and, therefore, his scientific thinking cannot be reconstructed, it is possible that he was a supporter of the immobility of the Earth and that he entered into the argument against Galileo.

The friendship between Querenghi, Tassoni, and Barisoni is also reflected in the support of both Querenghi and Barisoni for Tassoni's work. They were involved in the process of revising Tassoni's *La secchia rapita*, a work that Querenghi considered bound to succeed. Among those who read and suggested corrections to this were Pignoria and also Maffeo Barberini, the future Pope Urban VIII. In contrast to his predecessor, Pope Gregory XV, who wanted to censure the book, Cardinal Barberini suggested only a few corrections.[60] Despite the interest in *La secchia rapita*, as we will see, Tassoni yearned rather to publish his book entitled *Varietà di pensieri*. To grant Tassoni's wish, Paolo Gualdo attempted to try and get the *Varietà dei pensieri* published in Venice. In the event, Tassoni actually contrived to publish both *La secchia rapita* and the *Varietà di pensieri* at the same time as an effective strategy to promote the latter through the forthcoming success of the former.

Tassoni's friendship with Ciampoli was also beneficial for him. It has been said that Cardinal Maurizio of Savoy's hostility caused Tassoni to distance himself from the court for a short while. In 1623, during the pontificate of Urban VIII, a reconciliation between the two sides (Tassoni and the Roman Curia) was favoured by Giovanni Ciampoli, who had by then been promoted to the position of Secretary of Briefs to the Pope. Tassoni's Roman experience

[60] Tassoni decided to rewrite the work according to the amendments suggest by Pope Urban VIII, but only those copies sent to him in tribute. See, for example, Tiraboschi, pp. 202–3 and Nunziante pp. 187–88.

ended in 1632, and he entrusted the task of selling his book to Cassiano dal Pozzo once he moved to Modena.[61]

These are all facts that attest to Tassoni's acquaintance with leading figures in the Italian cultural landscape of the early modern era. Naturally, the cultural climate that surrounded Tassoni in Rome cannot be fully expressed by focusing on individual episodes; nonetheless, the relationship with such figures foreshadows the variety and richness of Tassoni's intellectual stimuli. The interactions among learned circles reveal how networks of knowledge played a role in shaping opinion about new discoveries and scientific controversies, which can still be recognised as peculiar, and often critical moments in early modern scientific culture.

1.4 WORKS

This section aims to offer a short presentation of Tassoni's works – other than the *Pensieri diversi* – so that a sense of his wide erudition can be achieved. This is not meant to be a systematic study of Tassoni's writings; rather, it is configured as a list of those writings that contributed to, and still demonstrate the reasons for, his fame. Therefore, the following list should be thought of as more of a reference source that can be consulted quickly for an overall impression of Tassoni's work. It reflects his wide interests rather than being a critical, historical, and philological study of his writings.[62]

Tiraboschi and Muratori had already provided information about Tassoni's production in their biographies, and this includes literary, political, historical, and philosophical works;

[61] See Renata D'Agostino, 'Due note Tassoniane', *Filologia e critica*, 4, nos. 2–3 (Rome: Salerno Editrice, 1979), pp. 416–33; Giuseppe Gabrieli, *La prima biblioteca Lincea o libreria di Federico Cesi* (Rome: G. Bardi, 1939).
[62] For a detailed bibliography of the editions of Tassoni's books, see Pietro Puliatti, *Bibliografia di Alessandro Tassoni*, 2 vols (Florence: Sansoni, 1969–1970), specifically the first volume that is entitled 'Edizioni'. My list of Tassoni's books does not include the editions of works published after his death if they were also published during his lifetime; however, each edition of the same book that appeared during his lifetime is reported. Tassoni's letters are omitted since these were published only in the nineteenth century (1827), even though Tassoni had already promoted the publication of his corpus of letters c. 1613. His wills likewise remained unpublished until Puliatti's volume; see Puliatti, pp. 390–425 and pp. 438–45.

however, the most considerable work on Tassoni so far, which was written by Giorgio Rossi, appeared in 1908, although it was incomplete.[63] Only in 1969–70 did a more consistent and systematic study of Tassoni's work appear, *Bibliografia di Alessandro Tassoni* – the two volumes entitled 'Edizioni' and 'Iconografia e Critica' – and it was published by Puliatti.[64] Even today these two volumes are still essential sources for those scholars who wish to approach the study of Tassoni's works.

Starting with the corpus of information provided by Puliatti, who also edited most of Tassoni's works, the knowledge about Tassoni's oeuvre continued to be enriched. A number of unedited manuscripts came to light, as did marginalia written by Tassoni in other works, and translations made by him. These were usually promoted at celebratory events that paid tribute to Tassoni, often conferences, whose proceedings are invaluable sources for a better and more complete understanding of Tassoni's work.[65]

The following list includes the editions of Tassoni's works published during his lifetime, works that appeared only after his death, and unpublished works or those wrongly attributed to him to support my claim about Tassoni's wide-ranging erudition.

Editions of Tassoni's books published by 1635

Considerazioni, *Avvertimenti*, *La tenda rossa* [1609–1613]. *Considerazioni* (*Considerazioni sopra 'Le Rime del Petrarca' d'Alessandro Tassoni, col confronto de' luoghi de' poeti antichi di varie lingue. Aggiuntavi nel fine una scelta dell'annotazioni del muzio ristrette, e parte esaminate*, Modena: Giulian Cassiani, 1609) was written by Tassoni about 1602 during his journey back from Italy to Spain, when he was working as secretary to Cardinal Ascanio Colonna. Its publication was openly discouraged

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[63] Giorgio Rossi, *Saggio di una bibliografia ragionata delle opere di Alessandro Tassoni con un discorso su gli scritti editi e inediti di lui* (Bologna: Zanichelli, 1908).
[64] Puliatti, *Bibliografia di Alessandro Tassoni*, cit. note 60.
[65] The most recent published volume that gathers together invaluable studies on Tassoni as an all-round intellectual is *Alessandro Tassoni. Poeta, erudito, diplomatico nell'Europa dell'età moderna*, ed. by Maria Cristina Cabani and Duccio Tongiorgi (Modena: Franco Cosimo Panini, 2017).

by Tassoni's friends, who feared repercussions because of his opposition to Petrarch, who was at the time an unquestioned authority. As it turned out, the predictions came true. Published in 1609, Tassoni's *Considerazioni* gave birth to a literary controversy in defence of the widely celebrated idol he had attacked. One of the first reactions to Tassoni's work, published in 1611, was written by Giuseppe degli Aromatari, who was a student of medicine in Padua. The text was entitled *Risposte di Giuseppe degli Aromatari alle 'Considerazioni di Alessandro Tassoni sopra "Le Rime del Petrarca"'*, and Tassoni did not hesitate to reply by publishing the *Avvertimenti* under the pseudonym of Crescenzio Pepe (*Avvertimenti di Crescenzio Pepe da Susa al Sig. Giosefo degli Aromatari intorno alle risposte da lui date alle 'Considerazioni del Sig. Alessandro Tassoni sopra "Le Rime del Petrarca"'*. Modena: Giulian Cassiani, 1611). In reply to Tassoni's book, another text by Giuseppe degli Aromatari, under the pseudonym of Falcidio Melamponio, appeared in 1613: *Dialoghi di Falcidio Melampodio in risposta agli avvertimenti dati sotto nome di Crescenzio Pepe a Gioseffe degli Aromatari*. The quarrel had now become violent and personal, and the increased criticism that was being hurled about ended with Tassoni publishing *La tenda rossa* (*La tenda rossa, risposta di Girolamo Nomisenti ai dialoghi di Facidio Melampodio*. Frankfurt [Modena], 1613).[66] By showing such strong opposition, Tassoni was countering a kind of dogmatism that was found particularly in academic environments.[67] To add fuel to the fire, Tassoni believed that hidden behind the words of Giuseppe degli Aromatari were the positions of his professors Cesare Cremonini and Paolo Beni. These polemical books reflect Tassoni's philosophical orientation admirably.[68]

Filippica I, s.t., 1615; *Filippica II*, s.t., 1615. These are Tassoni's polemical works opposing Spanish domination, and they focus principally on the military events that occurred in Monferrato. The

[66] *La tenda rossa* was published in Modena, but Frankfurt appeared as the place of publication on the title page. See, Puliatti, *Bibliografia*, vol. 2, p. 85.
[67] Cf. Marziano Guglielminetti, 'Tassoni e Marino', in *Studi tassoniani*, pp. 147–76.
[68] A modern edition of these works is still missing. Tassoni's philosophical orientation will be discussed in Chapter 2, Section 2.2. For the literary controversy involving Alessandro Tassoni, Cesare Cremonini and Giuseppe Degli Aromatari, see Antonio Daniele, '"Una pura disputa di cose poetiche, senza rancore di sorta alcuna". Alessandro Tassoni, Cesare Cremonini e Giuseppe degli Aromatari', in *Cesare Cremonini. Aspetti del Pensiero e Scritti*, ed. by E. Riondato and A. Poppi, vol. 1, pp. 19–41.

content of these works was actually disseminated prior to their publication in 1615. They received acclaim particularly because of their inclusion within collections of writings about different but related topics based on political controversies.[69]

[*Rime*], [1616–1630]. This title gathers together compositions on different topics, and before the nineteenth century was circulated principally in manuscript form. It contains everything from love lyrics to verses about politics, history, and civil life (1585–1599), and from extremely satirical sonnets to humorous–realistic poetry (1600–1613). It also includes ironic burlesque songs and pieces written as replies to specific situations concerning personal desires and ambitions, as well as the controversies in which Tassoni was involved (1617–34). These writings had verve and realism and, as such, contributed to Tassoni's choice of the mock-heroic genre for his most successful work, *La secchia rapita*. During Tassoni's lifetime only the following *rime* were published: 'Italia madre ai principi suoi figli' in *Replica alla risposta contra la quarta centuria de' 'Ragguagli di Parnaso'* and 'A Fulvio Testi' in *Rime di Fulvio Testi all'invittissimo Principe Carlo Emanuello Duca di Savoia*, Modena: Giulian Cassiani, 1617; 'Ad Antonio Bruni' in *Le tre grazie, rime del Bruni*, Roma, 1630.[70]

Risposta a una scrittura del Signor N.N., stampata pochi dì sono in Milano con questo titolo: Discorso nel quale si dimostra la giustizia dell'impero delli spagnuoli in Italia, e quanto giustamente sieno state prese l'armi da essi per la quiete d'Italia, disturbata del Duca di Savoia, conservator della libertà d'Italia ingiustamente intitolato, Roma, 1617. In 1617 in Milan, a text intitled *Discorso nel quale si dimostra la giustezza dell'imperio delli spagnuoli in Italia* was published under the name of Soccino Genoese. The aim of this Signor N.'s reply was to criticise the author's *Discorso* for his pro-Spanish and, therefore, anti-Italian stance. Signor N was, in fact, Tassoni, whom we know strongly supported Charles Emmanuel's campaign against the Spaniards. Indeed, he also confirmed he was the

[69] For more information about these writings, see Puliatti, *Bibliografia*, vol. 2, pp. 93−116.
[70] For more details about these writings, see Puliatti, *Bibliografia*, I, pp. 126–58. The *Rime* can be found published in Alessandro Tassoni, *La secchia rapita e scritti poetici*, ed. by P. Puliatti (Modena: Panini, 1989).

author of the *Risposta*, which is better known as *Risposta al Soccino Genovese*, despite denying he was the author of the *Filippiche*.

[*La secchia rapita* and *Oceano*], [1614–1630]: *La secchia poema eroicomico d'Androvinci Melisone. Con gli argomenti del Can. Alber. Baris. Aggiuntovi in ultimo 'Il primo canto de l'oceano' del medesimo autore*. Parigi, Tussan Du Bray, 1622.[71] *La secchia rapita* is Tassoni's most famous work, a mock-heroic epic poem written in ottava rima that consists of twelve cantos and is concerned with the rivalry between Modena and Bologna in the fourteenth century. The basis of the war between the two cities was Bologna's refusal to restore to Modena some towns that had been occupied since Frederick II was emperor. The wooden bucket, taken by the Modenese after having repulsed an invasion of people from Bologna, was used by Tassoni as a symbol of a war trophy. *Oceano* is an unfinished poem about Columbus's journey that ended with the discovery of America. Despite being incomplete, it is still possible to grasp Tassoni's enthusiastic attitude towards the new geographical discoveries. It was sent to Agazio di Somma as an example of how to rework the cantos in one of his own works on the same matter but written in a way that Tassoni strongly criticised.[72] Following the first edition printed in Paris, other editions of *La secchia rapita* and *Oceano* were printed in Italy between 1624 and 1630: *'La secchia rapita', poema eroicomico e ''L primo canto dell'oceano' del Tassone*, Ronciglione [Rome], 1624, *'La secchia rapita', poema eroicomico, e ''L primo canto dell'oceano' del Tassone*. Milan: Gio. Battista Bidelli, 1625,[73] *'La secchia rapita', poema eroicomico, e ''L primo canto dell'oceano' del*

[71] This work had already had a first manuscript circulation around 1618, whereas its publication was delayed until 1622. The delay was due principally to problems with the content, in particular, the many references to the local history of Modena and Bologna, as well as editorial and inquisitorial problems, which also affected the publication of the *Pensieri diversi*, as will be seen in Chapter 2. The printing of the poem in Paris in 1622 was successfully promoted by Jean Chaplain, but the work appeared under a pseudonym. The first reprint of the book in Italy appeared with the definitive title of *La secchia rapita*, and under the real name of its author in 1624. However, it shows an incorrect place of publication: Ronciglione rather than Rome. From 1625 onwards, the volume was disseminated widely both in Italy and abroad, and its success was assured; many copies were printed until the twentieth century, and it was also translated into English, German, and French, both of which facts argue for the interest of the work far beyond the century of its composition. See Puliatti, *Bibliografia*, I, especially p. 178. Another modern critical edition of *La secchia rapita* worth mentioning alongside the one edited by Puliatti (see note 41) is Alessandro Tassoni, *La secchia rapita*, ed. by Ottavio Besomi, 2 vols (Padua: Antenore, 1987–90).
[72] Tassoni's *Oceano* was the focus of a recent MA in philology and Italian literature by Elena Zandomeneghi: E. Zandomeneghi, 'L'Oceano di Alessandro Tassoni' (Master's thesis, Università Ca'Foscari, 2016).
[73] This is the text edited following the suggestions of Pope Urban VIII. It also appeared in some of the volumes printed towards the end of 1624.

Tassone. Venice: Giacomo Sarzina, 1625, *'La secchia rapita', poema eroicomico, del sig. Alessandro Tassoni, con le dichiarazioni del Sig. Gasparo Salviani, e ''L primo canto dell'oceano' nell'ultimo corretti con gli originali*. Venice: Giacomo Scaglia, 1630.

Posthumous works

[*Postille*]. Tassoni was also a keen book annotator.[74] Although his marginalia of major works did not achieve any credit during the seventeenth century, and were scarcely considered in the following centuries, they do reflect his philological interests. Among Tassoni's annotated books are the following: Dante's *La divina commedia*, Alan of Lille's *Cyclopaedia* (*Anticlaudianus*), Boccaccio's *Decameron*, Ariosto's *Orlando furioso*, Bracciolini's poem *L'elezione di Urbano VIII*, Castiglione's *Cortegiano*, Giuliano l'Apostata's *Misopogon*, Gian Francesco Maia Materdona's *Rime*, Giacomo Pergamini's *Memoriale della lingua*, Stigliani's *Del mondo nuovo*, Varchi's *Ercolano*, and a sample of the first (1612)[75] and second (1623) editions of the *Vocabolario degli Accademici della Crusca*.

The *Postille alla 'La divina commedia'* or, more precisely, some of them, were published in 1826 by Pietro Fiaccadori, but a complete edition, which was published by Giorgio Rossi, appeared only in 1904, and this includes other *Postille*. In general, however, selected *Postille* appear only in specific works by scholars interested in Tassoni's life and work.

Manifesto di Alessandro Tassoni intorno le relazioni passate tra esse e i principi di Savoia. This was written approximately in the years 1626–27 and is about the relationship between Tassoni and the Savoys. The tone is clearly polemical, reflecting Tassoni's bitterness towards the dynasty following the disappointing end to their relationship. It appeared for the first time in 1849, and was published by Pietro Campori as an appendix to his *Archivio storico italiano ossia raccolta di opere e documenti*

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[74] For information about Tassoni's *Postille* and on his collection of books, see Luca Ferraro, *Nel laboratorio di Alessandro Tassoni: lo studio del "Furioso" e la pratica della postilla* (Florence: Franco Cesati Editore, 2018).
[75] The text entitled *l'Incognito da Modana contro ad alcune voci del Vocabolario della Crusca* is a reaction to Tassoni's note to the *Vocabolario* (1612).

finora inedita o divenuti rarissimi risguardanti la storia d'Italia. Following this, it appeared in Giorgio Rossi's study of Tassoni and was edited by Roberto Bergadani in 1906.[76]

Ragionamento intorno ad alcune cose notate nel duodecimo dell''Inferno di Dante'. This was composed between 1595 and 1597 and is a literary composition written in support of the identification of a character present in Dante's book as Alessandro Fereo, as indicated by Alessandro Vellutello, rather than as Alessandro Macedone, as pointed out by Cristoforo Landini. Tassoni's text includes a philosophical reflection on the theme of anger, which is linked to his idea of war as an instrument of civilisation. The text was published for the first time in 1867 by Oreste Raffi and included in a publication to celebrate Marquise Riccarda Bastogi's wedding.

Difesa di Alessandro Macedone. This text, written in 1595, is strongly connected with the *Ragionamento* and with some of Tassoni's *quesiti* in his *Pensieri diversi* (VIII, 16–17 and IX 1–3). It focuses on the idea of the republic and develops his ideas about the profile of Machiavelli's prince, especially as far as his moral characteristics are concerned. In general, the themes that merged in Tassoni's political doctrine can be found in this text. The first edition, which was edited by Giorgio Rossi, was published in 1904, and was later published in the collection entitled *Raccolta di rarità storiche e letterarie* edited by G. L. Passerini.

Conclave in cui fu eletto papa Gregorio XV. Although Tassoni did not participate in the conclave after the death of Pope Paul V (he could have participated in this conclave because he was in the service of a cardinal), he probably wrote a report of the events as they were told to him by some friends. Found in a manuscript in Urbino (cod. Urb. Vatic. 844), it was published as late as 1910 in a miscellany dedicated to the memory of Antonio Maria Ceriani, prefect of the Biblioteca Ambrosiana.

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[76] See Gio. Pietro Viesseux, *Archivio storico italiano ossia raccolta di opere e documenti finora inedita o divenuti rarissimi risguardanti la storia d'Italia.* Vol. 7, *Appendice* (Florence: Deputazione Toscana di Storia Patria, 1849).

Enrico and *Locus penitentiae*. This was Tassoni's first attempt in 1583 at writing a poem, and reveals his interest in drama. However, Tassoni then set the text aside until he wrote the *Locus* in 1587, precisely with the intention of distancing himself from his earlier experiment. The tragedy was only edited as late as 1975 by Puliatti in his *Scritti inediti*.[77]

Compendio dell'una e l'altra istoria, ecclesiastica e seculare, estratto per via d'annali dal Cardinal Baronio et altri diversi autori dal nascimento di Giesù Cristo fino al mille e ducento. Con molte considerazioni curiose. Tassoni had probably started work on Cesare Baronio's *Annales ecclesiastici* in 1600, but his initial project of translation and annotation grew, and in 1631, by arriving at the year 1400, it had already gone beyond the chronological boundary of Baronio's original text. This work was partially edited by Puliatti in his *Annali e scritti storici e politici* between 1990 and 1993; Puliatti's volume also includes minor works that I have not included in this list, but which are strongly connected to the items that do feature.[78]

Unpublished Manuscripts

Grammatica italo–francese composta per uno che italiano non parla più che tanto (Modena, Biblioteca Estense universitaria, α. J. 9. 11).

Spurious works

Annotazioni sopra il 'Vocabolario degli Accademici della Crusca'. [Giulio Ottonelli], Venezia, 1698.

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[77] Alessandro Tassoni, *Scritti inediti: Enrico, Discorso in biasimo delle lettere, Pro episcopis Venetis apologia, Annotazioni al vocabolario della crusca, Genealogia, Guerra di Valtellina, Testamento*, ed. by P. Puliatti (Modena: Aedes Muratoriana, 1975).
[78] Alessandro Tassoni, *Annali e scritti storici e politici*, ed. by P. Puliatti, 2 vols (Modena: Panini 1990–1993).

This list provides a quick look at Tassoni's works that reflect his various interests. However, Chapter 2 focuses on his *Pensieri diversi,* which is persuasive proof of Tassoni's erudition per se.

CHAPTER 2: INTRODUCING TASSONI'S *PENSIERI DIVERSI*

This chapter focuses on Tassoni's *Pensieri diversi* with the aim of offering a sound understanding of the structure, contents, and intent of the book. Despite the considerable erudition revealed in this book, which at times almost risks an information overload, and the role it played in spreading scientific culture, very few studies have been dedicated to it. Scholars have focused their attention almost entirely on Tassoni's literary production, with the result that even today, the fame of the author of the *Pensieri diversi* is still linked principally with his mock-heroic poem *La secchia rapita* (The Rape of the Bucket) (1622). However, as has been shown briefly in Chapter 1, Tassoni's interests were so varied that it is impossible to consider them as belonging to the literary sphere only. In fact, they cover a myriad of fields including philosophy, history, politics, ethics, and science. This is particularly evident when looking at his *Pensieri diversi*, which in the context of my work plays a fundamental role: it is the volume through which Tassoni's natural philosophy is reconstructed.

The reasons behind the general overview of the *Pensieri diversi* presented here are twofold. First, the focus on the intrinsic features of this volume contributes to shedding light on the historical value of Tassoni's work. Too often, the book has been the subject of a mere cursory glance, and previous historiography has considered it to be just a bizarre text that gathers together different topics principally to satisfy Tassoni's wish to appear as an original writer. However, a systematic study of the volume reveals it constitutes a remarkable example of an early seventeenth-century encyclopedia, giving us access to the diverse and contentious issues that were being discussed in the first two decades of the century. Second, in comprehending the structure and content of the book, it is possible to gain an understanding of the methodology that was applied to build Tassoni's scientific profile and to isolate those topics that will appear in the three case studies I have selected as being representative of Tassoni's contribution to the cosmological debate.

The *Pensieri diversi* is not an easy book to approach: the topics discussed are not presented in a thematic order within the different branches of knowledge that constitute the entire volume; and also, the book consists of questions and answers. On the one hand, this facilitates rapid consultation of the volume but, on the other hand, makes it difficult to obtain a unified overview of the author's intellectual profile. In fact, the expository order of the book requires considerable amount of patience and flexibility to move from one question to another to piece together a systematic doctrine about a specific theme. Sometimes, the information needed to provide a complete assessment of a topic is scattered throughout different questions (*quesiti*), which often do not follow on one from another as would be expected, considering their thematic affinity; in addition, ideas already encountered in support of a certain theory are reused within a new theoretical framework and, therefore, are repeated at the expense of a more compelling writing style. However, as we will see, this sort of style does not denote a casual approach; rather, it seems to reflect a writing strategy aimed at making the volume a text that can be consulted quickly and, therefore, of use to a wider public, specifically, non-specialist readers. More precisely, I do not think Tassoni was missing systematicity on purpose, rather he opted for a specific literary genre which may imply missing systematicity as a consequence.

THE *PENSIERI DIVERSI*, A SEVENTEENTH-CENTURY ENCYCLOPEDIA

Structure and genre

The *Pensieri diversi* is a learned volume in which a wide range of topics encompassing different cultural domains is discussed. Over the long period during which he wrote and revised the book, Tassoni gathered together a plurality of themes that reflected his various interests and his great erudition. The variety of topics discussed shows that Tassoni was interested in almost all the cultural debates of his own time and, as we will see, the way in which he takes part in the debates reveals his eclecticism and critical attitude.

The rich and varied material assembled in the *Pensieri diversi* is organised into ten books. In broad terms, it can be said that the first five books deal with themes based on physics (i. e. natural philosophy), the sixth considers issues concerning ethics, the seventh focuses on literary topics, the eighth discusses political matters, the ninth is devoted to poetics and history, and the last, the tenth book, is a comparison between the achievements of the ancients and the moderns.[1] In addition, Tassoni chose the question and answer format to transmit knowledge: each book, except for the tenth, consists of a number of questions followed by short answers. More precisely, a question introduces a topic the author then discusses; therefore, the question serves as the title of a specific thematic section. For example, the title of *quesito* 1 of Book 1 of the *Pensieri diversi*, *Se ci sia l'elemento del fuoco* (Whether elemental fire exists), immediately suggests that this section deals with the theme of fire—one of the four basic elements of the terrestrial world in the Aristotelian tradition—to affirm or deny the existence of this particular element. The way in which Tassoni provides answers is interesting as well. Generally, he reproduces debates on a theme through the selection of specific sources and the use of numerous quotations that are representative of divergent opinions on a topic. Considering again the question (*quesito*) as to whether elemental fire exists, Tassoni presents both the Aristotelian and anti-Aristotelian sides of the argument, then inclines towards a particular viewpoint, building up his argument by using ancient and modern sources in support of his theoretical inclination, often adding new suggestions. It should be said that using the question and answer format as a way to examine specific topic has been considered a means of producing and obtaining knowledge since antiquity. Also referred to as disputation, this technique (Scholastic Quaestio) was a key mode of instruction and research in the early medieval universities and became increasingly prevalent during the thirteenth and fourteenth

[1] The comparison between ancients and moderns was most probably conceived as a single book different from the *Pensieri diversi*, see Tassoni, *La tenda rossa*, p. 187. However, it was not published in its own right before the nineteenth century (1827), see Puliatti, *Bibliografia*, vol. 1, p. 15−54.

centuries. Grounded in logic, it consisted of transforming a problem into a question with two opposite and equally reasonable positions (or theses). A debate about this question was then conducted dialectically or rhetorically until the arguments for one position were shown to be wrong and the opposing position consequently emerged as the correct answer and so the resolution to the problem. The most common approach in this debate was attempting to force one's adversary to contradict his own position; this approach became characteristic of the Aristotelian method.[2] As Olga Weijgers has explained, 'one could say that with this method Aristotle laid the basis of the *quaestio*, the dialectical procedure of discussion of a question or problem, which took on so much importance in later times'.[3]

Techniques similar to the disputation also appeared in contexts beyond Aristotelian method. Ancient authors used various approaches derived from the disputation, for instance: the florilegia, the *conclusiones*, the diatribe literature, and the commentary tradition.[4] Moreover, it became a method of inquiry in juridical and theological studies as well as in in physics and medicine, where this method was used to investigate natural principles and causes using evidence supplied by senses.[5] In these fields *questiones et responsiones* and problemata took hold; the problemata genre is the one most closely related with Tassoni's *Pensieri*.

A better understanding of Tassoni's volume also requires the correct comprehension of the features pertaining intrinsically to its literary genre. Without a firm understanding of the kind of book the *Pensieri diversi* is, in the wake of previous historiography there is still a high risk of viewing it as merely a chaotic assemblage of topics.[6] As I have mentioned, when

[2] For a detailed account on the use of the scholastic disputation, see Brian Lawn, *The rise and decline of the scholastic Quaestio disputata. With special emphasis on its use in the teaching of medicine and science*, Leiden: E.J. Brill, 1993.
[3] Olga Weijers, *In search of the truth. A history of disputation techniques from antiquity to early modern times*, Turnhout: Brepols, p. 38.
[4] For more information on this topic, see Olga Weijers, "Les genres littéraires à la faculté des arts", *Revue des sciences philosophiques et théologiques*, vol. 82, 4 (1998), pp. 631–41.
[5] Cf. B. Lawn, *The rise and decline*, pp. 21–38.
[6] Cf. Andrea Battistini, 'Avvisaglie del moderno in Alessandro Tassoni', in *Alessandro Tassoni: poeta, erudito, diplomatico*, pp. 15–16.

presenting different positions in each *quesito*, Tassoni not only stresses the tensions between different points of view by comparing theories, but also promotes his own ideas. In fact, rather than it being considered merely a summary of contemporary debates, Tassoni's collection of questions became an instrument that was used to formulate new theoretical proposals. These, although based on the sources employed, also departed from them, resulting in a system of new knowledge. The debate about natural philosophy, which is at the core of this thesis, will strongly affirm this aspect of the book.

The *Pensieri diversi* is not a scientific treatise; rather, as said above, Tassoni's writing strategies, along with the general structure of the book itself, reflect the features of the problemata,[7] a specific literary genre that situate it within the encyclopedic culture of the seventeenth century.[8] The genre, best known for the pseudo-Aristotelian collection of questions entitled *Problemata*, was highly successful in ancient times, and was then revived during the early modern era, until around the first half of the sixteenth century or shortly after.[9]

[7] For a broader discussion on this theme, see the following works to which this section owes a great deal: Iolanda Ventura, 'Quaestiones and Encyclopedias. Some Aspects of the Late Medieval Reception of Pseudo-Aristotelian Problemata in Encyclopaedic and Scientific Culture', in *Schooling and Society: The Ordering and Reordering of Knowledge in the Western Middle Ages*, ed. by A. A. MacDonald and M. W. Twomey (Leuven: Peeters, 2004), pp. 23–42; I. Ventura, 'Per Modum Quaestionis Compilatum...: The Collections of Natural Questions and Their Development from the Thirteenth to the Sixteenth Century', in *All You Need to Know: Encyclopaedias and the Idea of General Knowledge*, *Conference Proceedings, Prangins, Switzerland, 18–20 Sept. 2003*, ed. by P. Michel (Aachen: Shaker Verlag, 2007), pp. 275–318 (available online at: www.enzyklopaedie.ch); I. Ventura, 'Les recueils de questions-réponses à l'Époque Moderne. Une forme de transmission du savoir scientifique?', in *SHS Web of Conferences*, *vol. 22 (2015). Les séries de problèmes, un genre au carrefour des cultures. LabEx HASTEC, Paris, 2011–2014*, ed. by Alain Bernard Les (Ulis: EDP Sciences, 2015), published online (https://doi.org/10.1051/shsconf/20152200008); Paolo Cherchi, 'Il quotidiano, i "Problemata" e la meraviglia. Ministoria di un microgenere', *Intersezioni*, 21, 2 (2001), pp. 243–76.

[8] For an overview of seventeenth-century encyclopaedias, see Cesare Vasoli, *L'enciclopedismo del Seicento* (Naples: Bibliopolis, 1978).

[9] Aristoteles, *Problemata*, vol. 7, by E. S. Forster (1927), in *The Works of Aristotle*, 12 vols., translated into English under the editorship of W. D. Ross (Oxford: Clarendon Press, 1908–52). On the pseudo-Aristotelian problems, see Ann M. Blair, 'The "Problemata" as a Natural Philosophical Genre', in *Natural Particulars: Nature and the Disciplines in Renaissance Europe*, ed. by Anthony Grafton and Nancy Siraisi (Cambridge, MA: MIT Press, 1999), pp. 171–204.

The pseudo-Aristotelian *Problemata* consists of thirty-eight sections covering various matters from medical issues to psychological questions, from physics to ethics, and from botany to meteorology. There are also questions about the body, food, music, etc. Each section collects together different questions and answers presented in the formula διὰ τί/ 'η ὅτι, which emphasises the dialectic method of Aristotelian research. The answers consist principally of one brief reply or, when alternatives are possible, different short proposals, but do not offer a concrete solution; conversely, they always leave the process of investigation open. The problemata genre recalls Scholastic questions, and is a way of conveying the kind of knowledge that, corresponding to the Aristotelian assumption that 'verum scire est scire per causas' (true knowledge consists in knowing the causes), tries to understand the causes of the phenomena under examination. However, nearly always, the reply only reaches the level of an immediate physical and simple cause (i.e. efficient cause)[10].

Both the variety of the matters discussed, representative of the Greek curiosity that forms the basis of philosophical speculation, and the focus on topics of common interest, contributed to the fame of this genre, and despite the technical language and the fact that the phenomena considered are mainly devoid of any theoretical explanation, for centuries, the pseudo-Aristotelian collection of problems has been the model from which other collections of questions have taken their inspiration. Works that can be included in this genre include the following: Plutarch's *Questiones conviviales*; Seneca's *Naturales quaestiones*; Alexander of Aphrodisias's *Problemata*; Peter of Abano's *Conciliator*; and, in early modern times,

[10] For more information about the development of the genre of *quaestiones* literature within the Middle Ages, see Edward Grant, *Planets, Stars, and Orbs: The Medieval Cosmos 1200–1687* (Bloomington: Cambridge University Press, 1994), pp. 23–50; Iolanda Ventura, 'Aristoteles fuit causa efficiens huius libri: on the Reception of Pseudo-Aristotle's Problemata in Late Medieval Encyclopaedic Culture', in *Aristotle's Problemata in Different Times and Tongues*, ed. by Pieter De Leemans and Michèle Goyens (Leuven: Leuven University Press, 2006), pp. 113–44.

Marcantonio Zimara's *Problemata*, which was published posthumously and is principally found in Aristotle's and Alexander of Aphrodisias's collections of *problemata*.[11]

When released from its ancient dialectic model, the question and answer format also represented a suitable way of promoting knowledge for all those works characterised by an encyclopedic nature. Another relevant example taken from ancient times is Macrobius's *Saturnalia*. Over time, the genre proved more than capable of spreading knowledge at different levels. Old collections became sources that were quoted within new collections and new interrogative schemes were established, contributing to the evolution of the genre. Texts that returned to the question and answer format included vernacular works, for example, Girolamo Manfredi's *Il Perché* (1474), Giovanni Michele Savonarola's *Libreto de tutte le cose che se manzano comunemente* (published posthumously in 1508), Leonardo Giacchini's *Quaestionum naturalium libellus* (1540), Girolamo Garimberto's *Problemi naturali e morali* (1549), Ortensio Lando's *Quattro libri di dubbi* (1552) and, to a certain extent, Cardano's *De subtilitate* (1550) and *De rerum varietate* (1559).

Samples of the questions investigated in these collections are: Why do men cry both of joy and pain?[12] Why, among living beings, can only humans laugh?[13] Why are small animals more fertile than big ones?[14] Why do we value sight more than any other sense?[15] What is the Prince's purpose?[16] Why is the Holy Spirit named Paraclete?[17] These examples reveal the variety of questions and of fields encompassed by this genre. The genre in itself facilitates the

[11] Cf. Cherchi, pp. 249–65.
[12] Cf. Leonardo Giacchini, *De acutorum morborum curatione disputatio. Eiusdem, quæstionum naturalium, libellus* (Lyon: Seb. Gryphius, 1540), LXXI.
[13] Cf. Girolamo Garimberti, *Problemi naturali, e morali di Hieronimo Garimberto* (Venice: Bottega d'Erasmo di Vincenzo Valgrisi, 1549), I, 7.
[14] Cf. Ibid., II, 39.
[15] Cf. Ortensio Lando, *Quattro libri de dubbi con le solutioni a ciascun dubbio accommodate. La materia del primo è naturale, del secondo è mista (benche per lo piu sia morale) del terzo è amorosa, & del quarto è religiosa* (Venice: Gabriel Giolito de Ferrari, et fratelli, 1552), 75.
[16] Cf. Ibid., 196.
[17] Cf. Ibid., 325.

incorporation of a wide range of subject matter; however, the areas of knowledge covered depended very much on the authors, who, therefore, contributed to the evolution of the genre. It can be said that originality was not a particular feature of a collection of *problemata*: it is common to find the same questions within different collections, and there are also authors who incorporate excerpts from other works in their own texts. However, whereas the pseudo-Aristotelian model and the old collections dealt principally with natural philosophical questions, the later volumes encompassed many other disciplines, including religion, and the subject of love. In addition, the very short replies devoid of sources were replaced with longer answers, which tended to reproduce the debates of the time or provide a more concrete answer to the problems raised. These changes are also reflected in the structure of the volumes in that they became more organised; for example, they were divided into separate books. Beyond the different ways in which the authors deal with the questions, their works represent the renewal of an ancient genre that has always aimed to provide answers to specific questions about well-known events, often in relation to day-to-day experiences that were of common interest. Particularly useful comparisons to Tassoni's *Pensieri* are Girolamo Manfredi's *Il Perché* and Ortensio Lando's *Quattro libri di dubbi*, one of the works published close to the decline of this genre. Manfredi used the problemata genre to disseminate in Italian medical knowledge or, more precisely, rules for attaining good health.[18] Below are two examples dealing with food and physical exercise:

1. Why salted bread is lighter than unsalted bread, and the opposite should be true for the weight of salt. The humidity of bread is what makes it heavier; thus the drier the bread is, the lighter it

[18] Girolamo Manfredi, *Liber de homine. Il perché*, ed. by Anna Laura Trombetti Budriesi and Fabio Foresti (Bologna: Edizioni Luigi Parma, 1988).

remains. For the salt dries out the humidity, much more than the weight of salt itself; this is the reason that it [the salted bread] does not weigh [more].[19]

2. Why when we run fast, it seems that the air is a wind. For while we are running fast, the air offers resistance and violence against us so that we are struck by the air because of the resistance it makes to us. And because of this beating, which we feel, it seems that the air moves, and the moved air appears to us as a wind.[20]

Lando used this technique to consider questions of natural philosophy in the initial sections of his book; I present here two examples:

1. Why is the female is considered more imperfect than the male? Because of her native coldness.[21]
2. Why are baked stones coarser than others? Perhaps because fire makes them more solid and compact.[22]

As Paolo Cherchi underlined, Tassoni's *Pensieri diversi* represents both a peculiar re-emergence (1608) of this genre almost 50 years after the last similar publications, and also its zenith.[23]

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[19] 'Perché è più leggero il pan salato de peso, che non salato, e dovrebbe essere il contrario per lo peso del sale. La humidità del pane è quella che'l fa più grave, e quanto più è secco, tanto il pane rimane più leggero di peso. E perché il sale dissecca molto l'umidità, e molto più che non è il peso d'esso sale, imperò pesa manco', in Ibidem, I, i, 10.

[20] 'Perchè quando noi corriamo velocemente, pare, che l'aere sia un vento. Mentre che noi corriamo velocemente l'aere fa una resistenza e una violenza contro di noi: onde noi siamo percossi dall'aere per la resistenza, che fa a noi. E per tal percossa, che noi sentiamo, pare che l'aere si muova, e l'aere mosso ci appar[e] un vento', in Ibidem I, iv, 10.

[21] 'Perchè stimasi esser la femmina più del maschio imperfetta? Per la sua nativa freddezza', in O. Lando, 37.

[22] 'Donde aviene che le pietre cotte sono più delle altre grevi? Forse perché il fuoco le rende più solide e compatte', in Ibidem, 28.

[23] Cf. Cherchi, p. 270.

Tassoni used the potential of the genre widely and made a number of notable innovations to it. He poses questions in different forms,[24] and in his replies he aims to recreate traditional debates by making use of many sources drawn from a wide chronological arc, from ancient authorities (*auctoritates*) to modern references. In contrast to other collections of questions, Tassoni often quotes his sources, with the specific aim of incorporating them into the dialogue to offer the reader a wider picture of the problematic being discussed. Consequently, as we will see in Chapters 3, 4, and 5, with regard to the field of cosmology, the *Pensieri diversi* not only helps us to examine various questions concerning the culture of the time, but also to see them from the diachronic standpoint of the historical development of cosmological thinking.

Finally, at first glance, Tassoni's volume might seem an outdated and disorganised work within the intellectual context of the early modern era. The significance of Tassoni's book, as well as its historical value, however, emerges when considering the intrinsic features of the literary genre to which the *Pensieri diversi* belongs. Tassoni's volume is representative of a precise mindset that found a way of conveying knowledge and making it accessible to a wider public by using a collection of *problemata*. Even scientific topics, the understanding of which was too often limited to those with specialist knowledge, had wider appeal. However, because criticism of the disputation was widespread during the Renaissance, especially from humanists, and the dialogue was often preferred,[25] one might wonder why Tassoni did not decide to cast his volume as a dialogue. Since Tassoni seeks to show his own erudition, the dialogue genre was little suited to his goals; this genre forces the author to separate himself from his work by constructing characters who narrate his opinions for him. Consequently, the relationship between author and work is mediated by one or more fictitious characters that act as intermediaries between the author and the ideas expressed. While Galileo turned to the dialogue

[24] See Section 2.3.
[25] For information about the dialogue genre, see Virginia Cox, *The Renaissance dialogue. Literary dialogue in its social and political contexts*, Castiglione to Galileo (Cambridge: Cambridge University Press, 1992).

format to strategically distance himself from the controversial polemic against Aristotelianism that he presented, Tassoni does not thus seek to separate himself from his text. As the title of his work suggests, he presents ‘thoughts’ (*Pensieri*) that are presumably his own. *Pensieri* is, therefore, a literary genre aligned with Tassoni's aims, as suggested and evidenced by the letters in which Tassoni explains why he devotes so much effort to this work. These letters are analysed in the next section.

A scientific product: self-affirmation of value

Tassoni was aware of the value of the scientific aspect of the *Pensieri diversi* and greatly emphasised the work’s importance and deep erudition, considering it to be his masterpiece. Despite the attention given to *La secchia rapita* by modern historiography, Tassoni held the *Pensieri diversi* in the highest regard and did not expect to achieve fame for his poem. In the preface of *La secchia rapita*, Tassoni, speaking about himself in the third person, explains that he composed it not to gain fame in poetry but rather to satisfy his own curiosity about how burlesque and more serious genres could be mixed together in a work.[26]

It is undeniable that Tassoni created a new literary genre (the mock-heroic), but it is equally clear that he did not believe his success would be built on it. He considered poetry to be a leisure activity, compared with the intellectual effort required by the philosophical and scientific speculation that forms the *Pensieri diversi.*

Tassoni’s corpus of letters also confirms that Tassoni’s major concern was for the publication of the *Pensieri diversi* rather than his poem:

> I am torn in different directions about publishing this *Secchia* for various reasons, yet I have already ensured the possibility of publishing it; however, I will delay the task until I am certain about publishing the *Varietà de’ pensieri* without any further expense, because

[26] See Tassoni, *La secchia rapita*, ed. by P. Puliatti, p. 39.

> this [the publication of the *Varietà de' pensieri*] is what I care about most and I am not interested in becoming famous through jokes [the *Secchia*].[27]

And, again, with regard to *La secchia rapita*:

> I do not care about any praise that may come to me from that book [the *Secchia*]; rather, my interest is to find who could print the *Varietà*, which I will send to them with the final corrections and additions, with a different title, which, instead of *Varietà di pensieri*, will be *Dieci libri di varî pensieri*.[28]

The high regard Tassoni had for his *Pensieri diversi* might in some measure substantiate the hypothesis that this work deserves more attention from scholars, whose criticism of it might have been tempered by a more careful analysis of the volume. By focusing on Tassoni's cosmological ideas, this work moves a step or two in this direction, at least as far as the field of natural philosophy is concerned.

This brief overview of the structure and genre of the *Pensieri diversi* provides a first sense of Tassoni's erudition and eclecticism. The picture will be enriched in Section 2.2 by focusing principally on the intent of the book and its target audience. In addition, I will draw out the traits of Tassoni's philosophical profile, and so prepare the way for the analysis of his cosmological thinking.

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[27] 'Io son tormentato da varie parti a stampare cotesta *Secchia* e già ho assicurato di poterla stampare; ma io andrò trattenendo il negozio fin ch'io non sia sicuro di stampar la *Varietà de' pensieri* senza dispendio perché questo è il mio premore e non mi curo di farmi famoso con buffonerie.', in Tassoni, *Lettere*, vol 1, no. 350, p. 305. It is worth recalling that the *Pensieri diversi* had a long editorial history. It was only published with the title *Pensieri diversi* or, more precisely, *Dicei libri di pensieri diversi* (Ten Books of Different Thoughts) in 1620. This is the reason Tassoni refers to his book under its previous title of *Varietà di pensieri* in the letters.

[28] 'non mi curo punto d'alcuna lode che mi possa venire da quel libro e veggano di trovare chi stampi la *Varietà*, che questa manderò loro con l'ultime correzioni e giunte, col titolo mutato, che dove prima diceva *Varietà di pensieri*, ora dirà *Dieci libri di varî pensieri.*', in Tassoni, *Lettere*, vol. 1, no. 395, p. 344.

The target audience

Tassoni's Lettera al lettore

Tassoni wrote the *Pensieri diversi* in Italian at a time when the language of science and other areas of knowledge was still Latin, even though he himself was familiar with Latin. This decision deserves attention because it suggests Tassoni's intent to make his volume widely accessible and so to disseminate, through his book, scientific knowledge. Tassoni's intent is openly expressed in his *Lettera al lettore*:

> I also wanted to write about natural philosophy in the language commonly used in my country, not because I could not have written in Latin, but rather because I thought it was appropriate to follow nature where I did not seem to have need of art and, even more, since I flatter myself to be the first, if I am not wrong, to introduce into my own language a new doctrine by means of new opinions.[29]

Moreover, Tassoni sought not only to reproduce established scientific knowledge but also to participate in the debates concerning natural philosophy; he notes that he seeks to convey 'a new doctrine by means of new opinions'. This dual goal was key to Tassoni's decisions about the writing strategies for his book. It is interesting to notice that even though Tassoni preferred Italian because it offered the opportunity to reach a wider public, particularly readers not familiar with Latin, he nevertheless still acknowledged the importance and authority of Latin for his sources; he leaves the authors whom he quotes in Latin precisely 'to keep their import':

> In addition, my aim is to write for gentlemen and people who are not familiar with ancient languages, and it could seem perhaps even excessive to some of them that I have left the authorities among the included authors in Latin so as not to diminish their weight.[30]

[29] 'ho anche voluto scriver materie fisiche nella lingua che comunemente si scrive nella mia patria. Non che non m'avesse dato ancor l'animo di scriver nella Latina; ma emmi paruto di secondar la natura dove non ho stimato aver bisogno dell'arte; e tanto più lusingandomi il gusto d'essere il primo, s'io non mi inganno, a introdurre in essa una nuova dottrina con nuove opinioni.', in Tassoni, *Pensieri*, pp. 370–71.
[30] 'Aggiuntovi che'l mio fine è di scrivere a cavaglieri e signori, che non sogliono darsi agli studi di lingue antiche, e parrà forse anco troppo ad alcuni di loro ch'io abbia lasciate latine le autorità degli allegati scrittori per non iscemarle di peso', in Tassoni, *Pensieri*, pp. 371.

In addition, the scope of the book and the scientific/literary genre employed by Tassoni are well fitted to the volume's target readership: the question and answer format is easy to consult and clear to understand and thus very suitable for Tassoni's intended public, which also includes those erudite men who did not have the time to read long texts:

> I could be accused of having been too concise by those who said this already with regard to the first draft printed by Cassiani. But this is my chosen failing because I wanted the most to be brief and clear in my writings. So, please, let those who have free time and love long stories calm down because I want those who are very busy to be able to to read my things easily[31]

Therefore, led by Tassoni's declaration of intent, it is possible to identify a position for the book somewhere between the complex academic discourse of scholars and the learned, but not specialist, readers to whom Tassoni was aiming his work. In this sense, Tassoni's contribution to the dissemination of scientific knowledge goes farther than the widespread translation of Aristotle's work into Italian that was occurring with the aim of making Aristotelian texts intelligible to people of different educational levels.[32] As a point of comparison, it is worth mentioning Alessandro Piccolomini (1508–1578) because he both sought to popularise the Aristotelian *corpus* and incorporated innovative elements into his volumes, suggesting that he aimed to do more than simply disseminate the Aristotelian theories. In particular, Piccolomini discussed and expanded on many of the topics dealt with in Aristotle's *Physics* and *On the Heavens*; he added theories from late Scholasticism as well as

[31] 'Potrannomi appuntare di brevità quei che dello stesso appuntaron que' primi bozzi che 'l Cassiani diè fuori. Ma questo è mio elettivo peccato, non avend'io mai nelle scritture mie premuto in cosa più che esser breve e chiaro. Sì che quietinsi, di grazia, gli scioperati che aman le storie lunghe perch'io vorrei che anco gli affaccendati potessero senza danno legger le cose mie.', Ibid.

[32] For a valuable overview of both the use of Latin and the vulgarisation of scientific literature, see L. Olschki, *Bildung und Wissenschaft in Zeitalter der Renaissance in Italien,* vol. 2 of *Geschichte der neusprachlichen wissenschaftlichen Literatur,* especially pp. 285–304, in which Tassoni and his *Pensieri diversi* are discussed. For an overview of the process of the popularisation of Aristotle, see David Lines and Eugenio Refini (eds.), *Aristotele fatto volgare: tradizione aristotelica e cultura volgare nel Rinascimento* (Pisa: ETS, 2014); Marco Sgarbi, 'Aristotle and the People. Vernacular Philosophy in Renaissance Italy', *Renaissance and Reformation*, 39 (2017), 59–109 and, more widely, *Vernacular Aristotelianism in Italy from the Fourteenth to the Seventeenth Century*, ed. by Luca Bianchi, Simon Gilson, and Jill Kraye (London: Warburg Institute, 2016).

ideas opposing strict adherence to the Aristotelian model. I analyse Piccolomini's attitude towards Aristotle in greater detail in Chapters 4. Here, Piccolomini is mentioned as an interpreter of Aristotle, who, like Tassoni, did not merely accept and transmit Aristotelian natural philosophy but used Aristotle's positions as starting points for offering new ideas. Likewise, Tassoni sought to produce new knowledge by discussing Aristotle and other authors.

Tassoni approached the debates of his own time with a critical attitude and an eclectic spirit, ensuring he is able to tackle any topics correctly; his use of many sources suggests an aversion to adhering to a single author whose consequently isolated voice could hinder the search for accurate knowledge. Tassoni's attitude is well represented by his intellectual confrontation with Aristotle;[33] in general, this helps to delineate his philosophical and scientific orientation.

Tassoni's philosophical orientation

Tassoni was very knowledgeable about Aristotle, and despite the fact that he rejected certain aspects of the philosopher's theories, he did greatly appreciate his doctrine. An open statement of esteem is found in Book 10 of the *Pensieri diversi*. Here, in dealing with the comparison between the achievements of the ancients and the moderns in the field of natural philosophy, Tassoni emphasises Aristotle's prominence:

> If in natural philosophy we would like to compare the minds of our moderns with those of the ancient Greeks, there is no clear reason to do so; for although they were not the inventors of this doctrine, we nevertheless commonly recognize them as such, and we have from them those principles and means which they have taught us. And although some things in this matter have been perfected by ours [moderns] either by means of new instruments found or new countries discovered or by more certain experiences had, all this is nevertheless very little in comparison with what has been found and taught by the Greeks themselves and with what we ourselves have finally learned from them. Only what we

[33] For information about the use of Aristotle's authority in the intellectual production of early modern period, see E. Del Soldato, *Early Modern Aristotle: On the Making and Unmaking of Authority* (Philadelphia: University of Pennsylvania Press, 2020).

> recognize from Aristotle can confound any of our pretensions and obscure any more illustrious evidence of modern minds.[34]

The achievements of and the new discoveries made by the moderns are not neglected by Tassoni, who nonetheless stresses the invaluable legacy left by the Greeks in general, and by Aristotle in particular. However, this does not mean that Tassoni fully accepted Aristotelianism. Conversely, as we will see in Chapters 3, 4, and 5, his stance with regard to Aristotle varies considerably. Tassoni's opposition to Aristotelian theories is always something of a puzzle: at a time when reverence for Aristotle risked his ideas being turned into dogma, Tassoni adopted a critical stance in relation to Aristotelian doctrine and refused to endorse its blind acceptance.[35] In particular, Tassoni condemns this attitude within the Italian universities and criticises the existence of teaching positions devoted solely to teaching Aristotelian thinking. He points out that the Aristotelian professors provide an interpretation of Aristotle compatible with the Christian religion, but unfaithful and philologically inaccurate with regard to Aristotelian doctrine:

> It is certainly a pleasant thing among you Aristotelians that when your prophet [Aristotle] errs, you immediately begin to dispute his meaning, which is clear and plain, and give such a turn to his words as may seem best to you, and you even go so far to make him a Christian in spite of himself.[36]

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[34] 'se nella filosofia naturale vorremo paragonare gl'ingegni de' nostri moderni a quelli de' Greci antichi niuna efficace ragione il permetterà perciocché, nonostante che non sieno essi stati gl'inventori di questa dottrina, noi nondimeno comunemente gli riconosciamo per tali e da loro abbiamo que' principî e que' mezi che la ci insegnano. E ben che alcune cose in cotale professione sieno state perfezionate da' nostri o col mezzo di nuovi istrumenti trovati o di nuovi paesi scoperti o di più sicure esperienze fatte, tutto è nondimeno assai poco in paragone di quanto dai medesimi Greci è stato ritrovato e insegnato e di quanto finalmente noi stessi abbiamo imparato da loro. Che solamente quello che da Aristotile riconosciamo, può ogni nostra pretensione confondere e oscurare ogni più illustre prova degli ingegni moderni.', in Tassoni, *Pensieri* X, 5, pp. 849–50.

[35] Cf. Bruno Brunello, 'Motivi filosofici nel pensiero di Alessandro Tassoni', in *Studi tassoniani*, pp. 123–24.

[36] 'Ma è certo bellissima cosa di voi altri Aristoteleschi che, quando il Profeta vostro non dice bene, subito cominciate a negare il senso ch'è chiaro e piano, e vogliate adattare alle sue parole quello che a voi torna bene; e fin siate venuti a tale che a suo dispetto il facciate Cristiano.', in Tassoni, *Lettere*, vol. 1, no. 149, pp. 108–09. The letter concerns an objection from Professor Baldi with regard to Tassoni's question *Perché gli antichi adorassero il sole* (Why the ancients worshiped the Sun?). See Tassoni, *Pensieri*, III, 9, pp. 456–58. This criticism against Aristotle was also used by Petrarch in his *De sui ipsius ac multorum ignorantia*; giving Tassoni's acquaintance with the poet, it is possible that he was repeating his words here more or less consciously.

The words reported above are from a letter sent in 1613 to Camillo Baldi (1547–1634), who was a professor of logic and philosophy in Bologna.[37] Regardless of the context of the discussion, it is possible in the letter to grasp how Tassoni is reproaching the professors for celebrating Aristotle at the expense of academic freedom (*libertas philosophandi*) and the intellectual growth of their pupils:

> But you have good reason for what you do: for, if you did not employ this superstitious reverence [for Aristotle] to darken the minds of your pupils, they would begin to philosophise with the ancient freedom, and you would be in danger of losing the salaries which the public gives you because by means of sophistry you defend Aristotle's doctrine and all his illusions.[38]

Rather than submitting to academic servility, Tassoni claims the right to present new ideas that were different from the Aristotelian assumptions:

> I want to say new opinions: that is my goal. And it is the responsibility of my friends not to reproach me for what I may have said against Aristotle, but to reprove me for any impertinencies I may have advanced. You, instead, that have salaries thanks to Aristotle must defend his doctrines, right or wrong. But it is not the same for me.[39]

Similar statements criticising the staunch defenders of Aristotle are found in Tassoni's *La tenda rossa*.[40] I report just two excerpts in which the author criticises Cesare Cremonini and Paolo Beni, who were professors in Padua, and also their pupil Giuseppe degli Aromatari. The three of them mock the attitude of those who refuse to follow Aristotle's doctrine unconditionally without evaluating its validity, and they even consider Aristotle's opponents to be ignorant and foolish:

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[37] Cf. Chapter 1, Section 1.1.

[38] 'Ma voi altri avete ragione, che se non vi servite di questa superstizione ad offuscar gl'intelletti della gioventù, si tornerebbe a filosofare con l'antica libertà; e voi correreste il rischio di perdere i salari che vi dà il Pubblico, perché con sofisticherie difendiate la dottrina d'Aristotile e tutte le sue chimere', in Tassoni, *Lettere*, vol. 1, no. 149, pp. 108–09.

[39] 'io voglio dir delle novità, che questo è il mio scopo, e addimanto parere agli amici, non perché m'avvertiscono di quello che ho detto contro Aristotile, ma perché m'ammendano, se ho detto delle sciocchezze. Voi altri che siete stipendiati da Aristotile siete obbligati a difender la sua dottrina a diritto ed a torto; ma io non istò con lui', Ibid.

[40] See Chapter 1, Section 1.4.

> I do not believe that there is any opinion in the world more childish than that which denies reason and sense together. And this must be said despite the contrary opinion of that Greek Aristotle, who has found a handful of gourds so sweet with salt, that they not only hold constantly that he has never erred in anything he has said, but, what is worse, they go about preaching that those who are not of their sect are ignorant and mad.[41]

Conversely, Tassoni defines as gross and ignorant (*volgari ignoranti*) those who never depart from authority, Aristotle in this case, not even when both the senses and the intellect point to his flaws. They, Tassoni says:

> [they] follow always and in everything his [Aristotle's] opinions and hold superstitiously with Averroes, the pagan, as Melampodium also does, that he [Aristotle] could not err in any of his sayings.[42]

The battle against the 'principle of authority' fought by Tassoni has its roots in a famous topos. This emphasises the link between 'human nature' and 'fallibility' and aims to destroy the image of Aristotle as an 'infallible oracle'; it is usually attributed to Averroes. The topos was largely used during the Renaissance and the modern age but it dates back to Scholasticism. In that it was used by Averroes's successors, it became subject to theological and philosophical reflection in relation to any form of dogmatism.[43] An exemplary case of Tassoni's use of this topos is found in *quesito* 35 of Book 9 of the *Pensieri diversi*, *Se in filosofia si possa ad Aristotile contraddire* (Whether in philosophy it is possible to contradict Aristotle). Tassoni stresses that, despite Aristotle's vast knowledge, he was not infallible, 'Aristotle was a man and as a man he could err even if he was able to understand most things better than anyone

[41] 'Io non credo che ci sia al mondo alcuna opinione più puerile di quella che niega la ragione ed il senso insieme. E ciò sia detto con pace di quell'Aristotile greco, che ha trovato una mano di zucche così dolci di sale, che non solamente tengono per costante ch'egli non habbia mai errato in cosa alcuna di quante ha dette, ma, quello ch'è peggio, vanno predicando per ignorante e per pazzo chi non è della setta loro', in Tassoni, *La tenda rossa,* pp. 256–57.

[42] 'seguitano in tutto e per tutto le sue opinioni e tengono superstiziosamente con Averroè pagano, come fa il Melampodio, ch'egli non abbia potuto errare in alcun detto suo', in Tassoni, *La tenda rossa,* p. 164.

[43] See Luca Bianchi, 'Aristotele fu un uomo e poté errare': sulle origini medievali della critica al 'principio di autorità', in Luca Bianchi, *Studi sull'aristotelismo rinascimentale* (Padua: Il Poligrafo, 2003), pp. 101–24.

else'.[44] Therefore, Tassoni considers himself wise to contradict him and that it is legitimate to do so, 'In philosophy one can have opinions different from those of Aristotle and not be considered ignorant or dumb for this reason'.[45]

Tassoni also refers, although implicitly, to the relationship between Aristotelianism and Catholicism to show that anti-Aristotelianism does not coincide with the rejection of the Christian religion:

> I am aware I will be told that Petrus Ramus, Girolamo Cardano, and Bernardino Telesio, who, among our moderns, wanted to contradict Aristotle, were not only ridiculed but also had their works forbidden. But to this I respond that Ramus's and Cardano's works were not forbidden because they contradicted Aristotle's text, which indeed is not a text of the Holy Scripture that cannot be contradicted, but rather because with regard to religion they included many heretical things. Telesio's books were not forbidden but only suspended because that sharp mind [Telesio], in his eagerness to deny what Aristotle had said, also rejected some propositions that are theological principles. The same thing did not happen to [Francesco] Pico della Mirandola, who also wrote a volume devoted to the vanitas of the Peripatetic doctrine because he wrote more cautiously.[46]

Tassoni's philosophical profile begins to emerge, but the limits to his anti-Aristotelianism will appear in a more definite way when dealing with specific scientific topics in Chapters 3, 4, and 5, for which this section paves the way. These chapters will also provide more insight on Tassoni's attitude towards Aristotle, demonstrating that, as Eva Del Soldato claims, Aristotle's 'authority—even if constantly manipulated and negotiated—was the key to philosophical discourse and to the promotion of an agenda in almost any field'.[47] In other

[44] 'Aristotle fu un uomo anch'egli, e come uomo potè errare, nonostante che 'l più delle cose meglio degli altri intendesse', in Tassoni, *Pensieri*, IX, 35, pp. 837–38.
[45] 'in filosofia si può in molte cose avere opinione da quella d'Aristotele differente, e non essere perciò né ignorante, né sciocco.', in Tassoni, *Pensieri*, IX, 35, pp. 838.
[46] 'So che mi sarà rinfacciato, che Pietro Ramo, Girolamo Cardano, e Bernardino Telesio, i quali tra i nostri moderni vollero ad Aristotile contraddire, fecero non solamente burlarsi, ma proibir l'opre loro. Al che risponderò io, che l'opere de' primi due non furono proibite, perché le contraddicessero al testo d'Aristotile, il qual non è finalmente un testo d'Evangelio, a cui contraddir non si possa, ma perché in materia di religione elle contenevano molte eresie. E quelle del Telesio non furono proibite, ma solamente sospese, perché quell'ingegno acuto, per avidità di negare quanto aveva detto Aristotile, negò anche alcune proposizioni, che nella teologia servono di principi. Non così avvenne al Pico Mirandolano il secondo, che fece anch'egli un volume particolare della vanità della dottrina peripatetica, perché fu nello scriver più circospetto', Ibid.
[47] E. Del Soldato, *Early Modern Aristotle*, p. 153.

words, it was 'decisive in shaping the discursive strategies of early modern writers'.[48] Before approaching the thematic analysis of Chapters 3 to 5, it is worth explaining the methodology used in the selection of the three case studies. This is described in Section 2.3.

TASSONI'S COSMOLOGICAL THINKING: CONTENT AND METHODOLOGY

Three case studies: On motion, on the cosmos, on the immobility of the Earth

Although organicity is not a prerequisite for a collection of *quesiti*, it is true, nonetheless, that general doctrines and principles form the basis of each discussion. This is certainly evident in Tassoni's *Pensieri diversi*, both because of the boldness and heterogeneity of the matter dealt with and the many cultural references used. Bringing to light these doctrines in Tassoni's volume, especially as far as the field of natural philosophy is concerned, helps to delineate the intellectual profile of the author as well as provide a fresh approach to comprehending the early modern scientific debates.

The aim of Chapters 3, 4, and 5 is to delineate Tassoni's scientific profile more precisely by analysing a group of questions representative of the early modern cosmological debates. However, such a scope requires the selection of specific questions from among the many that inform Tassoni's book. These will then be organised into three main topics: motion, the cosmos, and the immobility of the Earth. These themes have been selected for their prominence in the scientific debates and for being particularly relevant for an understanding of the profound changes in the representation of the structure of the cosmos that took place in the second half of the sixteenth century and first half of the seventeenth century.

The selection process is described to clarify the methodology used to untangle the complexity and fragmentation of Tassoni's work and build up a system of knowledge able to reflect his cosmological thinking organically. In other words, this section explains the

[48] E. Del Soldato, *Early Modern Aristotle*, p. 2.

framework of reference used to choose and then isolate from the structure of Tassoni's *Pensieri diversi* three core themes concerned with early modern cosmology to create his cosmological doctrine.

It has already been mentioned that scientific theories were placed within the context of the more general education expected of a member of the educated elite at the time in question, and this includes familiarity with topics such as ethics and politics, and literary and historical matters. In fact, to a certain extent, the division of the *Pensieri diversi* into separate books reflects the different disciplines to which the topics discussed belong. Each book has a title that provides initial information about its content:

I. Caldo e freddo (Heat and cold)
II. Cielo e stelle (Heavens and stars)
III. Sole e luna (Sun and Moon)
IV. Aria, acqua e terra (Air, water, and earth)
V. Accidenti e proprietà diverse (Different accidents and characteristics)
VI. Disposizioni, abiti e passioni umane (Temperaments, habits, and human passions)
VII. Lettere e dottrine profane (Literature and secular doctrines)
VIII. Costumi di popoli e interessi di stato (Peoples' customs and state interests)
IX. Cose poetiche, istoriche e varie (Political, historical, and various matters)
X. Ingegni antichi e moderni (Ancient and modern minds)

The first four books are those within which *quesiti* on scientific topics can be found, and they are invaluable for the scope of this thesis. Looking at the seventy-one questions that comprise these four books, I selected those that were particularly relevant to the discussion of cosmological topics, for example, the structure of the celestial region and the matter from which it is created, the four elements (earth, water, air, and fire) from which the ancient Greeks believed the world was formed (supported by Aristotle), and the question of a geocentric versus a heliocentric universe (the questions chosen are ticked in the list provided).

Pensieri diversi, Books I–IV

Book I: CALDO E FREDDO (HEAT AND COLD)

1. *Che ci sia l'elemento del fuoco* (Whether elemental fire exists) ✓
2. *Se'l fuoco composto si muova allo'nsù* (Whether compound fire moves upward) ✓
3. *Se la gravità e legg(i)erezza sieno i primi principii del moto retto* (Whether heaviness and lightness are the prime principles of rectilinear motion) ✓
4. *Come il calore, sollevando le cose al cielo, discenda egli stesso di cielo in terra* (Why heat, raising things up towards the heavens, descends itself downward from the heavens to the Earth)
5. *Se il freddo muova* (Whether cold can generate motion)
6. *Perché nel medesimo clima sia maggior freddo nelle montagne che nelle pianure* (Why in the same climate it is colder in mountains than in plains)
7. *Perché il pane paia più bianco raffreddato che mentre è caldo* (Why chilled bread looks whiter than when warm)
8. *Perché il biscotto sia più duro caldo che freddo* (Why the cookie is harder when it is warm than cold)
9. *Perché l'acqua e la terra si possano riscaldare e l'aria raffreddare, rimanendo aria, acqua e terra; e il fuoco non si possa raffreddare senza perdere la forma di fuoco* (Why water and earth can be heated up and air can be cooled down while remaining air, water and earth, whereas fire cannot be cooled down without losing its own form) ✓
10. *Perché il fuoco liquefaccia il piombo e indurisca l'uova* (Why fire liquefies lead but hardens eggs)
11. *Perché il fiato dell'uomo con effetto contrario riscaldi le mani e raffreddi il cibo* (Why man's breath with contrary effect warms the hands and cool the food)
12. *Perché, bollendo al fuoco l'acqua d'un vaso, il fondo suo non cuoca a toccarlo* (Why the bottom of a vase does not burn after boiling the water in it upon fire)
13. *Perché tanto il gran freddo, quanto il gran caldo induri la terra* (Why both intense cold and intense heat harden the earth)
14. *Perché nel verno il gran freddo non lasci sentir gli odori* (Why in winter intense cold make odors unperceptible)
15. *Perché il gran caldo fuor di stagione soglia essere indizio di pioggia* (Why unseasonably warm weather is an indication of rain)
16. *Come, se nel calore consistono il vigore e la vita, il suo eccesso lievi le forze e la vita* (Why if heat consists of vigor and life, its excess takes away strength and life)
17. *Perché l'inverno sia maggior freddo dopo il solstizio che avanti* (Why winter is colder after the solstice than before)

Book II: CIELO E STELLE (HEAVEN AND STARS)

1. *Che sia il primo motor de' cieli* (What the prime mover of the heavens is) ✓
2. *Se le parti del cielo più calde si muovano più velocemente* (Whether the hottest parts of the heavens move faster) ✓
3. *Se il cielo che noi vediamo sia in varie sfere distinto o sia una e continua e uniforme materia per entro la quale si muovano i pianeti e le stelle* (Whether the heavens are divided into spheres or are made up of one continuous and uniform matter in which the planets and stars move) ✓
4. *Se i cieli si muovano di contrari moti* (Whether the heavens move by contrary motion) ✓
5. *Perché incessabilmente si muovano i cieli* (Why the heavens move incessantly) ✓

6. *Se la materia dei corpi celesti sia una sola senza mistura* (Whether celestial matter is comprised of a single substance) ✓
7. *Che cosa sieno le comete e come saliscano all'ottava sfera* (What comets are and how they reach the eighth sphere) ✓
8. *Come nella condensazione de' corpi le parti non penetrino l'una nell'altra* (How in the condensation of bodies the parts do not penetrate into each other)
9. *Che cosa sia il luogo, contra Aristotele* (What place is, contrary to Aristotle['s opinion])
10. *Perché il cielo e il mare paiono azzurri* (Why the heavens and the sea look blue)
11. *Perché i giorni della settimana non abbiano l'ordine de' pianeti, come hanno il nome* (Why the days of the week do not have the order of the planets, as they have the name)
12. *Perché Saturno e Marte stieno ne' cieli più alti, con Giove in mezzo* (Why Saturn and Mars are in the highest heavens, with Jupiter in between them)
13. *Se le stelle della Libra sieno infelici col Sole e se il nascere di Settembre sia di buono o di triste augurio* (Whether the stars of Libra are unhappy [when they are] in the Sun and whether to be born in September is a good or bad omen)

Book III: SOLE E LUNA (SUN AND MOON)

1. *Che cosa sia la luce* (What light is)
2. *Perché, se la luce non è calda, accenda l'esca riflettendosi dagli specchi* (Why light, if it is not hot, ignites the fuse by reflecting off mirrors)
3. *Perché il sole, ardendo come il fuoco, non arda l'aria* (Why the Sun, burning like fire, does not burn the air)
4. *Perché il sole, essendo caldo, non riscaldi l'aria a proporzione: più la vicina e meno la distante* (Why the Sun, being hot, does not heat the air proportionally [to the distance]: the closer more and the less distant less)
5. *Perché il sole induri il sale e liquefaccia il ghiaccio* (Why the Sun hardens salt and liquefies ice)
6. *Come il sole riscaldi l'aria e la luna non la riscaldi, che è più vicina a lei* (Why the Sun warms the air and does not warm the Moon, which is even closer to it [than the air])
7. *Perché, essendo contrari il sole ed il vento: l'un caldo e l'altro freddo, nondimeno ambidue rasciughino* (Why both the Sun and the wind, despite being opposites, the first hot, the second cold, dry [things] up)
8. *Perché il sole induri il fango e liquefaccia la cera* (Why the Sun hardens mud and melts wax)
9. *Perché gli antichi adorassero il sole* (Why the ancients worshiped the Sun)
10. *Come s'intenda quella proposizione: sol et homo generant hominem* (What the meaning is of the proposition: Sun and man generate everything that lives
11. *Se il calore sia sostanza o accidente* (Whether heat is a substance or an accident) ✓
12. *Da che procedano le macchie che si veggono nella luna* (What the cause of moonspots is)
13. *Perché la luna d'Agosto paia maggiore dell'altre* (Why the August Moon seems greater than the [Moon in] others [months])
14. *Perché le conchiglie del mare a luna piena siano migliori* (Why seashells are better at full moon)

15. *Che volessero significar le lune che anticamente i nobili romani portavano nelle scarpe* (What the meaning was of the moons that in ancient times the noble Romans wore in their shoes)
16. *Perché il sole, essendo caldo, raffreddi alcune cose* (Why the Sun, despite being hot, cools some things)

Book IV: ARIA, ACQUA E TERRA (AIR, WATER, AND EARTH)

1. *Perché, se l'aria è calda e umida, si geli in essa la state e si condensi la grandine* (Why, if air is hot and moist, it freezes and condenses the hail in summer)
2. *Perché la state si putrefaccino più le cose del verno* (Why things rot more in summer than in winter)
3. *Che sia più il gusto o il disgusto che l'uomo riceve dall'odorato* (Whether man receives more taste or disgust from smell)
4. *Perché il vento aquilone sia freddo e l'austro sia caldo* (Why the north wind is cold and the south wind hot)
5. *Perché il vento frequenti più e con maggior impeto in mare che in terra* (Why the wind is more abundant and more vehement in the sea rather than on the land)
6. *Perché i venti impetuosi ch'escono dalle nuvole cessino sopravvenendo la pioggia* (Why the vehement winds that come out of the clouds cease when the rain comes)
7. *Perché spirino più spesso aquilone ed austro che levante e ponente* (Why the north and south winds blow more frequently than east and west winds)
8. *Perché i venti feriscano di traverso* (Why the winds hit obliquely)
9. *Perché sudino i marmi* (Why marbles perspire)
10. *Perché la paglia conservi non pure le cose fredde, ma le calde eziandio, che non si corrompano* (Why straw preserves not only cold things, but warm things also, so that they do not deteriorate)
11. *Perché non si putrefacciano i corpi de' fulminati* (Why the bodies of those struck by lightning do not putrefy)
12. *Per che cagione la terra e l'acqua stieno unite al centro del mondo* (Why Earth and water are located at the centre of the universe) ✓
13. *Se l'acqua sia più alta della terra* (Whether water is above earth) ✓
14. *Se il centro del mondo sia nell'acqua o nella terra* (Whether the centre of the universe is in water or earth) ✓
15. *Perché l'olio stia sopra l'acqua* (Why oil stays on top of water)
16. *Perché, se il freddo è quello che imbianca, al bucato s'adopri l'acqua bollente* (Why, if cold is what whitens [things], boiling water is used for laundry)
17. *Perché nei siti australi l'acque abbiano del salso* (Why the waters are salty in southern places)
18. *Perché l'acqua marina sia men salsa vicino al lido* (Why seawater is less salty near the shore)
19. *Perché l'acque dei fiumi e de' laghi sieno più bianche di quelle del mare* (Why the waters of rivers and lakes are whiter than those of the sea)
20. *Perché ci raccapricciamo non solo quando ne vien gittato addosso acqua fredda, ma calda eziandio* (Why we become cold not only when cold water is thrown on us, but also warm water)
21. *Perché faccia nausea il navigar per l'acqua marina e non per li fiumi* (Why sailing in the sea causes nausea and sailing in the river does not [cause nausea])

22. *Perché nel cavarsi l'acqua del pozzo, la secchia pesi più fuori dell'acqua che dentro* (Why in retrieving water from the well, the bucket weighs more out of the water than in [the water])
23. *Perché, girandosi attorno una secchia piena d'acqua, ella non si versi* (Why a bucket full of water does not pour out [the water] when turning around)
24. *Perché nelle cime de' monti si trovino conchiglie* (Why shells are found on the tops of mountains)
25. *Se la terra si muova* (Whether the Earth moves) ✓

As the list shows, I have selected the sixteen *quesiti* where Tassoni primarily addresses motion, the cosmos, and the immobility of the Earth as my main focus. Tassoni's ideas about motion, the cosmos, and the immobility of the Earth will be analysed according to the scheme below.

CASE STUDIES	***QUESITI***
1. ON MOTION	I: 3; II: 1, 2, 4, 5; III: 11
2. ON THE COSMOS	I: 1, 2, 9; II: 3, 6, 7; IV: 12, 13, 14
3. ON THE IMMOBILITY OF THE EARTH	IV: 25

This scheme offers an overview of the topics that will be dealt with in more detail in the three case studies; however, it must be considered as a guide explicative of the methodology used rather than a strict rule limiting the use of the questions. Indeed, the same question may be used for more than one case study when the themes overlap, or references to other *quesiti* by Tassoni on cosmological ideas can be found occasionally. To sum up, this section has introduced the critical/historical analysis of examples of Tassoni's questions that I have selected and extracted from the *Pensieri diversi* to bring out his scientific profile in a systematic way.

CHAPTER 3: ON MOTION

This chapter focuses on Tassoni's theories of motion in order to understand more fully changing ideas about physics during the early modern era. Along with time, space, matter, and form, 'motion' was one of the predominant categories employed to comprehend the world and its physical reality. Tassoni's *Pensieri diversi* includes questions that attest to his sensibility towards changes in the concepts, such as motion, that are key to contemporaneous shifts in the representation of the cosmos. Studies on motion contributed to validating the heliocentric hypothesis as opposed to the Aristotelian–Ptolemaic system, which had been adopted since ancient times.[1] However, this change only happened after a long and complex process that encountered a number of objections before the new cosmological arrangement could take root in society.[2] In this chapter, I will analyse and interpret the ideas on which Tassoni grounds his theory of motion, demonstrating to what extent he contributed to the debates of his time about the nature and origin of motion.

To examine Tassoni's theory of motion, I rely primarily on the first two books of Tassoni's *Pensieri diversi*, which contain *quesiti* that allow us to comprehend Tassoni's main ideas on the topic. These are: I, 3. *Se la gravità e la leggierezza sieno i primi principi del moto retto* (Whether heaviness and lightness are the prime principles of rectilinear motion);[3] II, 1. *Che sia il primo motor de' cieli* (What the prime mover of the heavens is);[4] II, 2. *Se le parti del cielo più calde si muovono più velocemente* (Whether the hottest parts of the heavens move

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[1] There is a vast bibliography on cosmology and its history. Classical studies include Pierre Duhem, *Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols (Paris: Hermann, 1913–59); Edward Grant, *Planets, Stars, and Orbs*; Eugenio Garin, *Rinascite e rivoluzioni. Movimenti culturali dal XIV al XVIII secolo* (Roma: Laterza, 2007); Paolo Rossi, *La nascita della scienza moderna in Europa* (Rome: Laterza, 2011); *Change and Continuity in Early Modern Cosmology*, ed. by Patrick J. Boner (Dordrecht: Springer, 2011); Craig Martin, *Subverting Aristotle: Religion, History, and Philosophy in Early Modern Science* (Baltimore: Johns Hopkins University Press, 2014). However, more specific references will be provided in accordance with the themes gradually revealed as the thesis progresses.

[2] Arguments used against heliocentrism will be discussed in Chapter 5.

[3] Tassoni, *Pensieri*, pp. 385–88.

[4] Tassoni, *Pensieri*, pp. 409–11.

faster);[5] II, 4. *Se i cieli si muovono di contrari moti* (Whether the heavens move by contrary motion);[6] II, 5. *Perchè incessabilmente si muovano i cieli* (Why the heavens move incessantly).[7]

Assembling and analysing the *quesiti* is important because, as has been seen in Chapter 2, Tassoni's scientific ideas are not organised into thematic sections that offer his physical doctrine to the reader in a uniform way. Rather, arguments that would have been expected to be next to each other because of the connections between the themes being discussed are, in fact, often scattered throughout the *Pensieri diversi*, so that a systematic exposition of Tassoni's thinking about a specific topic is only possible by gathering together information distributed throughout different *quesiti*. This procedure demonstrates that Tassoni engages with debates about rectilinear and circular motion, showing an awareness of the principle from which motion originates. He also reflects on the consequences for cosmology and, in addition, speculates on the reason behind the incessant motion of the heavens. Although he never explicitly states a coherent theoretical framework for his scientific thinking, this does not mean he did not have one. Rather, it is possible to confirm that his theoretical principles are found in different *quesiti*, in which he also offers concrete examples showing an implicit scientific pattern. As a result, in this thesis, Tassoni's ideas on motion are reconstructed and systematised as a cohesive theory, something that would be difficult to achieve if the questions he asks were considered separately.

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[5] Tassoni, *Pensieri*, pp. 411–12.
[6] Tassoni, *Pensieri*, pp. 417–20.
[7] Tassoni, *Pensieri*, pp. 420–21.

3.1 THE PRINCIPLES OF MOTION IN ALESSANDRO TASSONI'S WORK

Internal or external mover?

Tassoni approaches the study of motion by considering the principles underlying the movement of the natural bodies; therefore, he claims to focus on natural principles, rather than on abstract entities that cannot be perceived.[8] Research on natural principles of motion has informed lively debates since ancient times, and theoretical frameworks that supported metaphysical explanations were constructed.[9] For example, the movement of the celestial spheres was considered to be caused by some kind of intelligence or by the direct action of God.[10]

During the sixteenth century, the so-called Italian naturalists began to question these dominant explanations.[11] They questioned the metaphysical approach to the study of nature and aimed to find a new way of investigating physical processes. The dissatisfaction with the methodology used and the receptiveness to innovation are well demonstrated by thinkers such as Bernardino Telesio (1509–1588), one of the most significant figures among the naturalists.[12] Firmly convinced that the human senses were a reliable means of investigating natural phenomena, Telesio was one of those modern thinkers that more intensely stressed the importance of reliance on both the senses and reason for a clear understanding of the natural

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[8] Cf. Tassoni, *Pensieri*, II, 1, p. 409.
[9] Michel-Pierre Lerner, *Il mondo delle sfere. Genersi e trionfo di una rappresentazione del cosmo*, transl. by Antonella del Prete (Milano: La Nuova Italia, 2000), pp. 245−88.
[10] Grant, *Planets, Stars, and Orbs*, pp. 488–569.
[11] For a general overview on the Renaissance and on the Italian naturalism, see *The Cambridge History of Renaissance Philosophy*, ed. by Charles B. Schmitt, Quentin Skinner, and Eckhard Kessler with Jill Kraye (Cambridge: Cambridge University Press, 1988) and C. Vasoli, *Le filosofie del Rinascimento* (Milan: Mondadori, 2002).
[12] For an overview on Bernardino Telesio and his natural philosophy, see Raffaele Sirri and Maurizio Torrini (eds.), *Bernardino Telesio e la cultura napoletana*, (Naples: Guida, 1992); Accademia Cosentina (ed.), *Atti del Convegno internazionale di studi su Bernardino Telesio: Cosenza, 12-13 maggio 1989* (Cosenza: Tipolitografia Di Giuseppe, 1990); Luigi De Franco, *Introduzione a Bernardino Telesio* (Soveria Mannelli: Rubbettino, 1995); Roberto Bondì et al. *Bernardino Telesio y la nueva imagen de la naturaleza en el Renacimiento* (Madrid: Siruela, 2013); Giuliana Mocchi, Sandra Plastina, and Emilio Sergio, *Bernardino Telesio: tra filosofia naturale e scienza moderna* (Pisa: F. Serra, 2012); Roberto Bondì, *Il primo dei moderni. Filosofia e scienza in Bernardino Telesio*. Rome: Edizioni di Storia e Letteratura, 2018.

world.[13] In his book, *De rerum natura iuxta propria principia* (1565), he stated his reliance on the senses and on what nature itself suggests in studying the world and everything which is part of it.[14]

Bernardino Telesio's epistemology was defended by Tommaso Campanella (1568–1639), who because he was in favour of Telesio's natural physics, championed him against the attacks made by the Aristotelian Giacomo Antonio Marta (1559–1629) in his *Pugnaculum Aristotelis adversus principia Bernardini Telesii* (1587).[15] Like Telesio, in the preface of his *Philosophia sensibus demonstrata* (1591), which was written in reply to Marta's volume, Campanella stressed the correct way of investigating nature so that an adequate knowledge of things could be acquired: nature must be studied by means of senses and experiences and not by following Aristotle's words.[16] Rather than human beings considering natural processes as incomprehensible, an understanding of these is thought to be within their grasp. By means of a close analysis based on sensible perceptions, man can even comprehend the inner and real principles underlying natural processes, whereas, conversely, the principles indicated by reason can be misleading.

This attitude can also be seen in Tassoni's text. In discussing themes under consideration, Tassoni appeals to the senses on more than one occasion. For example, he rejects the existence of the elemental fire, believing that 'it makes no sense trying to support by means of intellect

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[13] R. Bondì, *Il primo dei moderni*, pp. 92–96.

[14] Cf. Bernardino Telesio *De rerum natura iuxta propria principia, libri IX* [1586], ed. by Guido Giglioni (Rome: Carocci, 2013), pp. 13–14.

[15] Giacomo Antonio Marta, *Pugnaculum Aristotelis, adversus principia Bernardini* (Rome: Bartholomaeus Bonfandinus, 1587). See Roberto Bondì, 'Introduzione', in Bernardino Telesio, *La natura secondo i suoi principi*, ed. by R. Bondì, pp.VII –XXI.

[16] See Tommaso Campanella, *Philosophia, sensibus demonstrata, in octo disputationes distincta* (Naples: apud Horatius Salvianus, 1591). For a better understanding of Campanella's approach to the study of nature, see his *Praefatio*, pp. 1–14. For more information about Tommaso Campanella's natural philosophy, see Angelamaria Isoldi Jacobelli, *Tommaso Campanella. Il diverso filosofar mio* (Rome: Laterza, 1995); Michel-Pierre Lerner, 'La science galiléenne selon Tommaso Campanella', *Bruniana and Campanelliana*, 1 (1995), pp. 122–56; Paolo Ponzio, *Tommaso Campanella. Filosofia della natura e teoria della scienza* (Bari: Levante, 2001).

the existence of the [elemental] fire'; in fact, the senses show the contrary to be true.[17] More widely, the new thinking is reflected in the intention to investigate nature at first hand, rather than relying on the so-called authorities, which actually represent the major hindrance to the progress of knowledge.[18]

As far as the theme of motion is concerned, given the presence of contradictions and unsolved problems—or unclear solutions—within metaphysical arguments, the Italian naturalists of the sixteenth century proposed a new explanation for the cause of motion. By reworking the idea of *impetus*, these natural philosophers considered motion to be a characteristic specific to and inherent in some kinds of bodies and not something that occurred as the result of an external motor.[19] In short, the theory of *impetus* opposes the Aristotelian idea of violent motion. Violent motion refers to those bodies that are pushed away from their natural places, for example, a stone thrown upward by an individual or an arrow fired upward from a bow. Aristotle stated that this kind of motion can occur because the motor moves both the body and the medium in which the object is moving, for example, the air, which therefore continues to keep the body in motion until the force that is being exerted by the medium, in this case, the air, dissipates, and the body starts to move towards its natural, or eventual resting place.[20] The theory of *impetus*, however, offered a more effective explanation with regard to some of the events experienced during daily life that were apparently incompatible with Aristotelian

[17] 'vanità l'andar con l'intelletto fantasticando che vi sia fuoco', in Tassoni, *Pensieri*, I, 1, p. 374.

[18] Cf. R. Bondì, *Il primo dei moderni*, pp. 29−59.

[19] Cf. Alexandre Koyré, *Études galiléennes* (Paris: Hermann, 1966), pp. 11−79; Nicoletta Sciaccaluga, 'Movimento e materia in Bacone: uno sviluppo telesiano', *Annali della Scuola Normale Superiore di Pisa. Classe di Lettere e Filosofia*, Vol. 2, no. 1, Scuola Normale Superiore, 1997, pp. 329–55.

[20] Cf. Aristotle, *On the Heavens*, III, 2, p. 281, in Aristotle, *On the Heavens*, trans. by W. K. C. Guthrie, Loeb Classical Library 338 (Cambridge, MA: Harvard University Press, 1939). Unless otherwise indicated all references to and quotations from Aristotle's books are from the Loeb Classical Library (LCL). This is important to specify because Tassoni quoted from sixteenth-century Latin editions of Aristotle and, consequently, there is not uniformity between my own references to Aristotelian books and Tassoni's references (number of the excerpt quoted (text), number of the book, title of the book. For example: 41 [text] of [Book] 1 of the *Fisica [Physics]*). However, the excerpts quoted by Tassoni and the English translations which I include here are the same. By means of comparative analysis of an extensive number of Tassoni's quotations (in addition to those included here), it has been possible to verify that Tassoni is most likely to have read the Iuncta edition of Aristotle's work: Aristotle, *Omnia quae extant opera,* 11 vols. (Venice: Giuntina, 1573–76).

physics, for example, the reason for which it is impossible to throw a lightweight body too far away.

This theory had its precedent in the objections that had been raised against Aristotle since the sixth century by the Neoplatonic John Philoponus, and it was adopted and reworked by Islamic philosophers. However, in the fourteenth century, Jean Buridan expresses it more clearly. In *Subtilissimae quaestiones super octo physicorum libros Aristotelis* (1509), Buridan states that the movement of the projectile is not due to the whirlwinds (or the medium in which the object moves) but is the result of a force, or *impetus*, transmitted by the motor to the body itself that allows it to continue to move—if not stopped by any hindrance—at the same rate, until the force exerted (determined in relation to the speed and the size of the object) runs out under the actions of contrary forces. Nevertheless, even with a new orientation as opposed to Aristotle's theory of motion, the theory of *impetus*, in terms of the physics involved, did not invalidate the Aristotelian premises, for example, the 'externalism' of the forces doing the moving.[21]

Given the above, the theory that bodies have an internal motor, a theory that was held by the Italian naturalists, led its supporters to engage in a fierce debate about the theoretical model of Aristotelianism that was dominant at the time. Before the sixteenth century, studies on motion came under the field of physics, which was part of the discipline known as natural philosophy.[22] Because the natural philosophy (*philosophia naturalis*) of Aristotle was the leading theoretical model until the second half of the sixteenth century and beyond, a comparison with Peripatetic (Aristotelian) thinking was a necessary step both for those who

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[21] Cf. Alessandro Gisalberti, *Giovanni Buridano dalla metafisica alla fisica* (Milano: Vita e Pensiero, 1992).

[22] Daniel Garber, 'Physics and Foundations', Ann Blair, 'Natural Philosophy', and Domenico Bertoloni Meli, 'Mechanics', in *Early Modern Science*, edited by K. Park and L. Daston, vol. 3 of *The Cambridge History of Science* (Cambridge: Cambridge University Press, 2008), pp. 21−69, 365−406, 632−72. For a general overview on the evolution of natural philosophy, see Edward Grant, *A History of Natural Philosophy: From the Ancient World to the Nineteenth Century* (Bloomington: Cambridge University Press, 2007).

remained faithful to the Aristotelian paradigm and those who, in contrast, called into question the pillars of Aristotelianism.[23] As a result, the Italian naturalists gave birth to a new set of doctrines.

The innovators (*novatores*) argued against the Aristotelian theory, according to which everything that moves is put in motion by something else. Instead, they aimed to separate the physical sphere from the metaphysical one when studying physical processes.[24]

As far as Aristotle was concerned, each kind of motion—natural or violent (*praeter naturam*)—was the result of the force of an external mover. The action of an external agent at the origin of a body's movements is fairly evident in the case of violent motion. As claimed, it is the motive force transmitted both to the body and the medium in which it moves, for example, the air. However, according to Aristotelian thinking, the distinction between the motor and the moving body also concerns natural motion. The body has the potential to move; thus, there needs to be a cause for it to move to realise the transition from the potentiality to the actuality of the motion.[25] Moreover, with regard to natural motion, a further distinction is needed. This concerns the difference between the voluntary motion of the animated being and the motion of inanimate bodies, and is explained by Aristotle through the theory of natural places: in the case of animated beings, the agent is the soul, whereas, in relation to unanimated bodies, the cause of motion is what/who grants them the potentiality to move in their own direction:

> Since then all things that are in motion either move according to their proper nature or in violation of it and under compulsion; and all things whose movement is unnatural are set in motion by some agent external to them; and things whose movement is natural are also set in motion by some agent, whether (like animals) they move themselves (in the sense that they embrace both the active and the passive factors of motion in their organism), or do not move themselves, as for instance light and heavy substances, which are moved

[23] E. Grant, 'Aristotelianism and the Longevity of the Medieval World View', *History of Science* 16 (1978), pp. 93–106; Charles H. Lohr, 'The Sixteenth-Century Transformation of the Aristotelian Natural Philosophy', in *Aristotelismus und Renaissance*. *In memoriam Charles B. Schmitt*, ed. by Eckhard Kessler, Charles H. Lohr and Walter Sparn (Wiesbaden: Harrassowitz, 1988), pp. 89–99.
[24] Cf. E. Berti, *Dalla dialettica alla filosofia prima* (Padua: CEDAM, 1977).
[25] Cf. Aristotle, *Physics*, VIII, 4, pp. 313–15, in Aristotle, *Physics, Vol. 2: Books 5-8*, trans. by P. H. Wicksteed, F. M. Cornford, LCL 255 (Cambridge, MA: Harvard University Press, 1934).

> either directly by what agent soever generates them and makes them light or heavy, or incidentally by the agent that removes the obstruction or hindrance—if all this is so, I say it follows that all things in motion are moved by some agent.[26]

In addition, the origin of any motion is a result of the circular motion of the heavens, and even celestial motion depends on the action of a prime cause. By assuming the principle according to which an endless succession of movable movers is impossible, Aristotle is driven to the conclusion that the motion of the heavens is originated by a first, immovable mover, separate from the universe, a theory that is dealt with in his *Metaphysics*.[27]

In opposition to Aristotle, Tassoni's thinking is in line with the new trend of viewing motion as a feature pertaining to the intrinsic nature of certain bodies. The Aristotelian speculation on the existence of an external prime mover, which is commonly interpreted as God, is rejected and qualified as a discourse suitable for theologians and metaphysicians. As we shall see, it does not mean that Tassoni refutes God as the Creator of the world or His omnipotence. In matters of faith, he is always cautious, and is careful to avoid the accusation that he is discrediting the Christian religion; nonetheless, he openly states that the prime focus of his investigation is research into natural principles and the second the causes of (celestial) motion.[28]

The first clear signal of Tassoni's knowledge of and, in certain terms, affinity with theories elaborated by the natural philosophers of sixteenth-century Italy, is found in his assumption of cold and heat being the natural principles that form the basis of rest and motion. Generally, the idea that heat is the fundamental principle for motion to occur is at the core of

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[26] Aristotle, *Physics*, VIII, 4, p. 317. See also Aristotle, *On the Heavens*, I–IV.
[27] Aristotle, *Metaphysics*, XII, in Aristotle, *Metaphysics, Vol. 2: Books 10-14. Oeconomica. Magna Moralia*. trans. by Hugh Tredennick, G. Cyril Armstrong, LCL 287 (Cambridge, MA: Harvard University Press, 1935). See also Andrea Falcon, 'A Late Ancient Discussion of Celestial Motion: PSI XIV 1400', *Papiri filosofici* 4 (2003), pp. 129–41.
[28] Cf. Tassoni, *Pensieri*, II, 1, p. 409.

Tassoni's physics. Whether inherent in a body or generated through external means, the subject first needs to have heat applied to it for motion to occur:

> who can doubt that heat is not what gives motion to all things which move by themselves according to their nature, eternally to the eternal [things] and finitely to the corruptible and finite [things]? Animals move and live as long as the heat lasts in their hearts and blood, and when that ceases, they die and become motionless and cold. A flame moves as long as the nourishment of its heat lasts. Comets, shooting stars and other similar occurrences move for as long as the hot vapours last in them. And the heavens and the stars move eternally because they are made of eternal and incombustible matter which endlessly produces the heat that moves them. And here motion ends because above the celestial bodies there is neither heat nor moving matter.[29]

Thus, both objects that are moved by something else and those which move by virtue of their own volition are in motion because of heat. Conversely, cold objects do not move. By building his theory of motion on the function of cold and heat, Tassoni favours the idea of internal movers.

Two things are worth noting. First, the use of cold and heat with regard to motion played a significant role in the work of other prominent thinkers during the Renaissance, including Bernardino Telesio (1509–1588), Tommaso Campanella (1568–16391), Girolamo Fracastoro (1478–1553), Girolamo Cardano (1501–1576), and Giordano Bruno (1548–1600).[30] These figures who populated the Italian cultural landscape of the sixteenth century were very well versed in scientific topics; they were natural philosophers or physicians involved in the study of nature both for theoretical and practical reasons. The fact that Tassoni's interests overlap with those of these respected thinkers is representative of his mindset: Tassoni wanted to position himself among those natural philosophers who discuss the key contemporaneous

[29] 'chi potrà dubitare che il calore non sia quello che dia il moto a tutte le cose che si muovono da se stesse secondo l'esser loro, eternamente all'eterne e finitamente alle corruttibili e finite? Gli animali si muovono e si vivono per quanto dura loro il calore nel cuore e nel sangue e, mancato quello, si muoiono e si rimangono immoti e freddi. La fiamma si muove per quanto dura il nutrimento del suo calore. Le comete, le stelle cadenti e l'altre impressioni si muovono per quanto dura in esse l'esalazion calda. E i cieli e le stelle si muovono eternamente perché sono di materia eterna e incombustibile che senza fine fomenta il calor che gli muove. E qui finisce il moto perché sopra i corpi celesti non è calore né materia mobile.', in Tassoni, *Pensieri*, II, 1, p. 410.

[30] Charles B. Schmitt, Quentin Skinner, and Eckhard Kessler (eds.), *The Cambridge History of Renaissance Philosophy* (Cambridge: Cambridge University Press, 1988), pp. 199–300.

questions about physics.[31] We have already seen in Chapter 2 that Tassoni did not want to achieve glory by means of his literary production, but rather because of the philosophical contribution offered in his *Pensieri diversi*. By analysing Tassoni's cosmological ideas, we can see how he showed his competence outside of the field of literature and his skilled participation in contemporaneous scientific debates.[32]

Second, Tassoni not only dealt with the same topics as these renowned authors and *novatores*, he also re-elaborated the ideas he shared with them. The two concepts of cold and heat permeate Tassoni's entire natural philosophy; however, in looking at the way in which he built his scientific thinking by studying the *quesiti* selected for critical analysis, it can be noted that he constantly reworks and introduces amendments to the system of knowledge used in shaping his questions and answers. Thus, it will be possible to verify his customary manner of making innovative use of his sources with the aim of supporting his theories.

The following sections situate Tassoni's discourse on motion in its cultural context, thus offering a contribution to the understanding of the historical significance of Tassoni's scientific production and shedding light on the complexity of the debates about natural philosophy at the beginning of the modern era.

3.2 Rectilinear motion

Motion of heavy and light things

As the main tenet of Tassoni's natural philosophy, reasoning on cold and heat is found in different *quesiti*, including the one in which the author reflects upon rectilinear motion.

[31] See Steven Shapin, 'The Man of Science', in *The Cambridge History of Science*, ed. by K. Park and L. Daston, vol. 3, pp. 179–92. For a reflection on the concepts of 'natural philosophy' and 'science' see, Andrew Cunningam, 'The Identity of Natural Philosophy: A Response to Edward Grant', *Early Modern Science and Medicine* 5, no. 3 (2000), 259–78.

[32] For the relationship between science and literature, see Eraldo Bellini, *Stili di pensiero nel Seicento italiano. Galileo, i Lincei, i Barberini* (Pisa: ETS, 2009), pp. 30–42.

Rectilinear motion applies to bodies located in the terrestrial region and will be discussed in this section. The motion of the celestial region (circular motion), which is complementary to the reconstruction of Tassoni's theory of motion, is the focus of Section 3.3.

The debates about motion, to which Tassoni contributed, occurred within a framework that was, essentially, Aristotelian. Tassoni himself refers first and foremost to the theories supported by Aristotle and which appeared in the commentary tradition that had developed from the fifteenth century onwards and originated in the *corpus Aristotelicum*.[33]

Not only does Tassoni question Aristotle's idea of rectilinear motion (*lactio recta*) in the light of the natural principles of cold and heat, he actually rejects the Aristotelian theory, according to which the prime cause of rectilinear motion is the heaviness (*gravitas*) or lightness (*levitas*) of bodies. Instead, he supports the thesis positing that the prime natural principles at the origin of rectilinear motion are cold and heat: 'Here a new and odd thought occurs to me: that the first principles that give motion to things from the centre to the circumference and from the circumference to the centre are not gravity and lightness, as Aristotle avers, but heat and cold'.[34]

The theories held by Aristotle concerning motion are found principally in his works *On the Heavens* and *Physics*. The natural bodies in the sublunary world are subject to different kinds of transformations, among which is the actual moving that occurs when a body changes its place: 'For, wherever anything changes, it always changes either from one thing to another,

[33] For Aristotle's commentary tradition, see Paul Moraux, *L'aristotelismo presso i Greci*, 3 Vols. (Milan: Vita e Pensiero, 2000).
[34] 'Qui mi si fa luogo ad un pensier nuovo e curioso: che i primi principii che danno il moto alle cose dal centro alla circonferenza e dalla circonferenza al centro non sieno la gravità e la leggierezza, come Aristotile vuole; ma il caldo e il freddo', in Tassoni, *Pensieri*, I, 3, p. 385.

or from one magnitude to another, or from one quality to another, or from one place to another'.[35]

As we have already seen, this motion can be either natural or unexpected and violent. In the *quesito* we are focusing on, Tassoni considers the rectilinear motion of inanimate bodies, which is a natural motion. This is based on Aristotle's theory of natural place: each body in the terrestrial realm moves naturally with a rectilinear motion, which is an upward or downward movement, based on the dominant constitutive element that also determines its heaviness or lightness. Indeed, the four natural elements themselves are characterised by a descending or ascending motion depending on whether they are heavy (earth and water) or light (air and fire). The downward motion towards the centre of the Earth is characteristic of those bodies that are mainly composed of earth or water, whereas the motion upward and away from the centre of the Earth is typical of those bodies that are composed principally of air or fire. Consequently, there are two different motions produced by two opposing natures (heavy or light), which make the bodies move spontaneously in the direction determined by their principal component. This means that both heaviness and lightness are, according to Aristotelian theory, real characteristics that relate to two different kinds of bodies.[36]

The theoretical foundation of rectilinear motion in relation to cold or heat—rather than heaviness or lightness—supported by Tassoni immediately recalls the naturalistic viewpoint and, in particular, the Telesian stance, which as we will see, dominates Tassoni's natural philosophy. However, if the naturalistic component of Tassoni's thinking is easy to determine—both because he uses key concepts shared with the Italian natural philosophers and because of the presence of explicit sources that confirm the connection between his thinking

[35] Aristotle, *Physics*, III, 1, p. 195, in Aristotle, *Physics,* trans. by P. H. Wicksteed, F. M. Cornford, LCL 228 (Cambridge, MA: Harvard University Press, 1957), vol. 1. See Andrea Falcon, *Corpi e movimenti. Il De caelo di Aristotele e la sua fortuna nel mondo antico* (Naples: Bibliopolis, 2001).
[36] Aristotle, *Physics*, IV, 1, pp. 277−83. See also Andrea Falcon, *Aristotle and the science of nature: unity without uniformity* (Cambridge: Cambridge University Press, 2008), especially pp. 55−84.

and the naturalistic viewpoint—a closer look at this *quesito* suggests that he combines his reasoning with hypotheses originating from disputes that occurred within a different cultural milieu. In interpreting Tassoni's *quesito* on the rectilinear motion of heavy and light bodies, I propose that it was shaped not only by naturalistic thinking but also by the debates that occurred during the second half of the sixteenth century and the first decade of the seventeenth century in Tuscan intellectual environments, both within academia and outside of it.

The theory of the motion of the elements (*de motu elementorum*), within which discussions about the motion of heavy and light bodies must be included, has, in fact, a long tradition, and its roots can be found in Scholasticism.[37] Against the background of Aristotelianism, within which heaviness or lightness were considered to be ontological characteristics of bodies, the role these characteristics played with regard to bodies' upward or downward motion was widely discussed. In particular, questions were asked as to what precisely 'heaviness' and 'lightness' were, and whether they were actually the only causes of motion or whether external forces were also involved in generating and defining this.[38]

The debate was still active and widespread in the second half of the sixteenth century, and the Studio Pisano played a significant role in shaping theories to achieve a correct understanding of the nature of the motion of bodies. Figures of particular interest were Girolamo Borro (1512–1592), Francesco Buonamici (1533–1603), and Galileo (1564–1642), who were representative of a number of leading figures in discussions about Aristotle's natural philosophy in general, and on the question of the motion of heavy and light bodies in

[37] For a general overview about Scholasticism and Humanism or, more generally, on the Italian Early Renaissance, see Jill Kraye, 'The Philosophy of the Italian Renaissance', in *The Renaissance and 17th century Rationalism*, ed. by G. H. R. Parkinson, Routledge History of Philosophy, 4 (London: Routledge, 2003), pp. 15−64.
[38] Michele Camerota and Mario O. Helbing, 'Galileo and Pisan Aristotelianism: Galileo's De Motu Antiquiora and the Quaestiones De Motu Elementorum of the Pisan Professors', *Early Science and Medicine* 5, 4 (2000), 325–28.

particular.[39] Both Borro and Buonamici were 'ordinary' professors at the Studio Pisano, and participated extensively in the debate about the upward or downward motion of light or heavy bodies, respectively. Each dedicated an impressive work to this topic: Borro's *De motu gravium et levium* (1575) and Buonamici's *De motu libri X* (1591).[40] Galileo was their pupil, and recent studies have highlighted the role these professors' ideas played in Galileo's writing of his so-called *Juvenilia*.[41]

Ideas on the topic were circulating by means of the theories upheld by Buonamici, Borro, and Galileo. In particular, Borro and Buonamici supported two different theories to explain the motion of terrestrial bodies. These represent the *status questionis* (scholarly consensus) on the topic at the end of the sixteenth century admirably and paved the way for Galileo's early speculation on motion.[42] Moreover, even if Tassoni did not explicitly mention either Borro or Buonamici in the *quesito* about rectilinear motion, both of them figure in Book 10 of the

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[39] Cf. Ivan Giuseppe Malara, *Galileo Galilei e il tema cosmogonico della creazione del mondo*. *Tesi di laurea* (Printout, Università degli studi di Milano, Facoltà di studi umanistici, Corso di laurea magistrale in Scienze filosofiche, 2015–16), pp. 49–59.

[40] Girolamo Borro, *De motu gravium et levium* (Florence: Officina Georgii Marescotti, 1576); Francesco Buonamici, *De motu libri X* (Florence: Bartholomaeus Sermartellius, 1591). My discussion here relies mainly on Camerota and Helbing, 'Galileo and Pisan Aristotelianism', pp. 318–65. For a better understanding of concepts and terminology relevant to this case study, see also Paolo Galluzzi*, Momento. Studi galileiani* (Rome: Edizioni dell'Ateneo e Bizzarri, 1979).

[41] Galileo Galilei, *Iuvenilia*, ed. by Antonio Favaro, 20 vols. (Florence: Barbera, 1890–1909), vol. 1, pp. 8–177. For a discussion about the influence of Borro and Buonamici on the work of the young Galileo, see Michele Camerota and Mario O. Helbing, 'Galileo and Pisan Aristotelianism: Galileo's De Motu Antiquiora and the Quaestiones De Motu Elementorum of the Pisan Professors', *Early Science and Medicine*, 5, 4 (2000), 319–65 and D. Bertoloni Meli, *Thinking with Objects: The Transformation of Mechanics in the Seventeeth Century* (Baltimore: Johns Hopkins University Press, 2006), p. 51. A different opinion was held by Adriano Carugo, Alistair C. Crombie, and William A. Wallace, who established a link between Galileo's *Juvenilia* and the Jesuit texts, in particular with Benedict Pereira's work; see, for example, Adriano Carugo and Alistair C. Crombie, 'The Jesuits' and Galileo's Ideas of Science and Nature', *Annali dell'Istituto e Museo di Storia della Scienza di Firenze*, 8 (1983), 3–67; Adriano Carugo, 'Les jésuite et la philosophie naturelle de Galilée. Benedictus Pererius et le "De motu gravium" de Galilée', *History and Technology*, 4 (1987), 321–33; William A. Wallace, *Galileo's Early Notebooks: The Physical Questions. A Translation from the Latin with Historical and Paleographical Commentary* (Notre Dame: University of Notre Dame Press, 1977). For more details about these diverse theories on Galileo's sources in his early works, see Ivan Giuseppe Malara and the bibliography he lists in Ivan Giuseppe Malara, 'Galileo and His Sources? A Different Methodological Approach to Galileo's "Juvenilia"', *Galilaeana: Journal of Galilean Studies*, 16 (2019), 1–40. On Galileo's *De motu antiquiora*, see also Stefano Salvia, 'From Archimedean Hydrostatics to Post-Aristotelian Mechanics: Galileo's Early Manuscripts De Motu Antiquiora (ca. 1590)', *Physics in Perspective*, 19 (2017), 105–50.

[42] In particular, Buonamici's volume explicitly criticised Borro's book. In general, Buonamici, who follows the interpretations of Aristotle that appear in the ancient Greek commentaries, criticised the Averroistic position embraced by Borro. Galileo himself critically discussed both Borro's and Buonamici's positions, and we will see in the following sections that with regard to the theory of motion he was particularly critical of Buonamici.

Pensieri diversi, suggesting that Tassoni had some knowledge of their theories. Borro and Buonamici are included here together with other protagonists in the debates about motion, such as Simone Porzio, Francesco Piccolomini, and Jacopo Mazzoni. All these natural philosophers contributed to the current glory of natural philosophy, according to Tassoni:

> But about the glory of the Greeks in natural philosophy much is said, and it is sufficient for our moderns to have surpassed in this doctrine all the other nations of the world since them [the Greeks]. For it is well known that neither the Romans nor the Saracens had, except for Averroes, [people such as] Pendasi, Piccolomini, Porzi, Ficini, Porti, Cremonini, Raimondi, Toledi, Bonamici, Mazzoni, Bori, and so many other famous people of our time.[43]

In addition, Tassoni was in Pisa towards the end of the sixteenth century and it is possible that he had the opportunity to learn about the theories of motion that had been discussed within the Studio Pisano for a long time.[44] More generally, when Tassoni introduced cold and heat as the principles behind rectilinear motion at the beginning of his *quesito*, he himself claimed this was a 'new and odd thought',[45] most likely because he had in mind precisely the controversy *de motu elementorum*, within which heaviness or lightness were considered to be those characteristics of bodies that caused motion. In fact, even if Borro's and Buonamici's theories about the motion of bodies were completely different, they were both of the Aristotelian school of thought and assumed the above was indeed the case.

The wide and complex range of topics that converge within the dispute about the motion of heavy and light bodies makes it necessary to narrow down the investigation to specific themes. Therefore, I will restrict my focus to those ideas concerning the natural motion of

[43] 'Ma della gloria de' Greci nella filosofia naturale sia detto assai e basti a' nostri moderni l'aver superate in questa dottrina tutte l'altre nazioni del mondo, da essi in poi. Che ben è noto che non ebbero i Romani né i Saracini, trattone Averroè, i Pendasi, i Piccolomini, i Porzi, i Ficini, i Porti, i Cremonini, i Raimondi, i Toledi, i Bonamici, i Mazzoni, i Bori e tant'altri famosi che ha veduto e vede la nostra età', in Tassoni, *Pensieri*, X, 5, p. 851.

[44] If we also consider that Buonamici's book was completed in 1587 (although it was only published in 1591), it is possible to infer that in the years during which Tassoni most likely frequented the Studio Pisano (1586–87) the theme of motion was a central issue within erudite circles.

[45] 'un pensier nuovo e curioso', in Tassoni, *Pensieri*, I, 3, p. 385.

mixed bodies (mainly inanimate bodies) according to Tassoni's assumptions; the theme of floating bodies will be particularly highlighted.

Mixed bodies are those comprised of a combination of the four elements (earth, water, air and fire), and according to the Aristotelian theory of natural place, the ascending or descending motion of a mixed body occurs in accordance with whichever element (light or heavy) it is mainly composed of. As far as Buonamici is concerned, inanimate bodies (both single elements and mixed bodies) are unable to move by themselves.[46] In fact, the motion of bodies results from the action of an external cause or originator (*generans*), and whether a body is heavy or light also depends on the action of the *generans*.[47] Contrary to Buonamici and following Averroes's approach, Borro favoured the idea of internal movers. For each body, Borro distinguishes between the form (*pars movens*), and the matter (*pars mota*): the heaviness or lightness of the bodies is the form of the constituting elements and, consequently, the efficient cause of the bodies' motion.[48]

Furthermore, arguing against the Platonists and the atomists, Buonamici claimed that heaviness was not due simply to the amount of matter bodies were composed of. More precisely, he introduced a distinction between *gravitas extensive* and *gravitas intensive*. The first concerns the quantity of matter (*pondus*), the latter the intensity of its form (*species gravitatis*). A body's *species gravitatis* plays the most important role with regard to its motion. In fact, if the heaviness or lightness of bodies were determined only by the quantity of matter, then a larger quantity of air would be heavier than a very small quantity of water, or a tiny

[46] The philosophy of Francesco Buonamici has been dealt with extensively in Mario O. Helbing, *La filosofia di Francesco Buonamici professore di Galileo a Pisa* (Pisa: Nistri-Lischi, 1989). Those of Buonamici's arguments presented in this thesis are mainly drawn from Chapters 5 and 6 of Helbing's volume. See also Chapter 12, which discusses Buonamici's influence on Galileo's works.
[47] For more details, see Helbing, *La filosofia di Francesco Buonamici*, pp. 151–57.
[48] See Borro, *De motu*, p. 167.

quantity of earth would be lighter than a big fire. On the contrary, experience shows these suppositions to be absurd.[49]

Within this framework, which is still strongly Aristotelian, Tassoni's *quesito* shows the intellectual autonomy of its author, who in searching for a key according to which he could understand nature, critically evaluated the existing contemporary theories and then, finally, proposed his own idea. Indeed, the question on the motion of heavy and light bodies is particularly representative of Tassoni's attitude with regard to scientific debates. He discusses a topic rooted in the Aristotelian context, but combines it with new suggestions, pushing forward an anti-Aristotelian approach. Accordingly, in this *quesito*, the focus is still on *gravitas* and *levitas* as characteristics of the bodies, but the entire reasoning is oriented to demonstrate that, contrary to the statements made by Aristotle's disciples, heaviness and lightness cannot be assumed to be the principles behind the rectilinear motion of bodies. Rather, according to Tassoni, *gravitas* and *levitas* are dependent on either cold or heat, respectively, being present. Consequently, rectilinear motion is derived first and foremost from cold or heat, which, being the real first basic characteristics of bodies, determine their heaviness or lightness and, therefore, their tendency to move in a specific direction.[50]

Support for this theory is found by Tassoni directly in Aristotelian texts, especially *On Coming to Be and Passing Away*. Tassoni's aim is to show that his theory is not contradictory to, but rather inferred from, the doctrine of the characteristics of bodies found in Aristotle's statements.[51] Aristotle's *On Coming to Be and Passing Away* belongs to his group of works on natural philosophy and is primarily devoted to discussing the different kinds of transformation bodies can undergo. Such transformations concern their origins and the ways in which they can become corrupted, their growth or reduction, how they can be altered, and the change that

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[49] For more details, see Helbing, *La filosofia di Francesco Buonamici*, pp. 205–08.
[50] Tassoni, *Pensieri*, I, 3, pp. 385.
[51] Ibid.

concerns place (moving bodies) which, however, is almost unconsidered in this work.[52] Nevertheless, because Tassoni's reasoning is based on the characteristics of bodies that are linked to the changes they undergo, from which he draws the agents of motion, he explicitly refers to this book to build up his argument with regard to the cause of rectilinear motion.

Tassoni considers the effects on a body caused by certain characteristics, for example, in this case, cold or heat, which, along with dry or wet, are considered by Aristotle as 'first, irreducible oppositions'.[53] Tassoni then points out that the thickening of bodies (and their accompanying increasing heaviness) is due to the action of cold. More precisely, according to Tassoni, bodies are made heavy by the action of cold, which makes them denser and more tightly connected, and, conversely, they are made light by the action of heat, which divides them and makes them thinner. In fact, Tassoni does not exclude the notion that heavy bodies move downward, whereas light bodies move upward, but he stresses that the heaviness or lightness of bodies is a result of the action of cold or heat. Further, Tassoni considers these opposing characteristics in terms of their origin, and concludes that cold and heat are not based on any principle other than the 'hand of God' (see quotation below). Consequently, they are the first natural principles from which other characteristics are generated, for example, dense or thin, or heavy or light:

> It is true that Aristotle himself in [the section] 8 of [Book] 2 of *On Generation and Corruption*, includes among the primary elemental qualities weight and lightness as well as density and translucence. But if we consider things in terms of generation and origin and not as already made, as if without a beginning, we will see that of the four qualities already mentioned, we can assign the origin and the cause to cold and to heat; whereas of these two [heat and cold] we cannot determine any efficient cause, nor any beginning, other than the hand of God.[54]

[52] Cf. Aristotle, *La generazione e la corruzione*, ed. by M. Migliori and L. Palpacelli (Milan: Bompiani, 2013). See in particular the introduction by M. Migliori, pp. XIII–LVII.
[53] Aristotle, *La generazione e la corruzione*, II, 2–3, pp. 38–41.
[54] 'È vero che il medesimo Aristotile nell'8 del 2. della *Generazione*, tra le prime qualità elementali il grave e il leggiero e il denso e il vano connumera. Ma se consideriamo le cose in via di generazione e di origine e non come prodotte, come senza principio, vedremo che delle quattro già dette, si può assegnar l'origine, e la cagione al

The comparison with Aristotle, which was aimed at drawing attention to self-contradiction in the Aristotelian framework, was common practice at the time, and over the course of this thesis we will see that Tassoni often used this strategy. By doing so, he could more likely have expected to build up a new argument that would have been perceived as compelling or, at the very least, difficult to criticise, even by Aristotle's disciples. Therefore, not surprisingly, on the one hand, he distances himself from Aristotle, stressing the contradictions that would make the Aristotelian doctrine unreliable. However, on the other, he tends to reinforce his own statements not only by adapting Aristotelian words in favour of his theories, but also by recalling thinkers who were at odds with Aristotle, yet who, nevertheless, were not reproached by the Greek philosopher. For example, this latter strategy is used by Tassoni when he mentions Parmenides as a prominent philosopher who supported the idea of cold and heat as the first principles behind rectilinear motion. References to Parmenides can be found in Aristotelian texts, and Tassoni cites Book 1 of *Physics*, in which Parmenides is mentioned, along with Democritus, in the context of the discourse on the origin of things. Specifically, Aristotle talks about those who considered opposites (*contraria principia*) to be the natural principles behind all nature. This idea is considered 'reasonable' by Aristotle,[55] and Tassoni apparently wanted to make it clear that his thinking and that of Parmenides were in agreement, probably to emphasise that because Aristotle did not criticise Parmenides, he himself would have not been criticised by Aristotle: 'Parmenides too, as we read in 41 [section]

freddo, ed al caldo; dove di queste due non possiamo assegnare altro efficiente, né altro principio, che la mano di Dio', in Tassoni, *Pensieri,* I, 3, p. 387.

[55] 'This leads us to observe that all these thinkers assume as principles some "pair" of antithetical qualities or forces. They do this whether they declare these to be light or heavy (even Parmenides makes 'hot' and 'cold,' which he calls 'fire' and 'earth,' into principles), or whether they speak of thin or dense' […] Clearly, then, they all assume a certain number of antithetical couples as principles, and not without reason, because 'principles,' being themselves primary, must not be derived either from each other or from anything else, and all other things must arise out of them', in Aristotle, *Physics*, I, 5, pp. 51–53.

of [Book] 1 of the *Physics*, in his philosophy considered heat and cold as first principles; and Aristotle does not blame him for doing this'.[56]

By means of these strategies, Tassoni established a dialogue with the most authoritative source of his time, Aristotle. His dialogue with Aristotle is crafted in such a way that the assumption that cold and heat are the first principles of motion cannot be argued with, not even in an Aristotelian context; Tassoni defended this assumption by listing short quotations from Aristotle and Plutarch that are considered to offer confirmation of this, thereby demonstrating the support of well-known sources for his theory.

I will provide more evidence of Tassoni's writing strategies later on, in the thematic analysis that informs this chapter and also in the two case studies (Chapters 4 and 5). Here, I would like to stress that Tassoni mentions authors and texts widely quoted at the time, for example *Problems*, *Meteorology*, *Generation of Animals*, and *On Plants* by Aristotle and *On the Principle of Cold* by Plutarch,[57] which were, therefore, expected to be known and held in high regard by members of the educated elite. If on the one hand this is in line with his aim to write principally for a wider public, on the other, looking at this particular *quesito*, we can already see clearly that Tassoni engages at a high level with topics of contemporary scientific interest. It would appear, then, that his other aim was to offer a contribution towards a better understanding of the universal principles behind the physical phenomena. The following section, which focuses on the disputes that originated from the intellectual Tuscan landscape, adds evidence to this claim.

[56] 'Parmenide anch'egli, come si legge nel 41. dell'1. della *Fisica*, nella sua filosofia pose per primi principii il caldo e il freddo; e in questo Aristotele non lo biasima', in Tassoni, *Pensieri*, I, 3, p. 387. See also Michel-Pierre Lerner, 'Le parménidisme de Telesio. Origine et limites d'une hypothèse', in *Bernardino Telesio e la cultura napoletana*, pp. 79−105.
[57] Cf. Tassoni, *Pensieri*, I, 3, p. 386.

Theories of acceleration and floating bodies

The debates about motion include a number of questions related to understanding the behaviour of different bodies, for example: What is the relationship between *gravitas*/*levitas* (heaviness/lightness) and speed? Does the *medium* in which the body moves play a role in its motion? Is the shape of the body a determining factor with regard to its motion? How can floating bodies be explained?

In the second half of the sixteenth century, one of the widespread theories of acceleration was that of *antiperistasis*. The supporters of this theory, including Borro, stressed the active role played by the medium in the natural motion of bodies.[58] At the theory's core is the idea of the mutual replacement between the body and the portion of space previously occupied by the medium in which the body moves:

> since nature abhors a vacuum, when something is moved in a medium, the surrounding parts of the medium immediately run behind the moving body to fill the space without leaving it empty. Once set in motion, these parts of the medium push the body by their own thrust and move it onwards. The greater the number of parts, and the greater the impulse by which they are set in motion, the more swiftly and forcefully they run to the back of that body, and the faster they push and move it.[59]

The speed of bodies is, therefore, strongly connected with the number of parts of the medium moved by the body: a greater number of parts results in a greater motive force and, consequently, a faster motion of the body that is being pushed by the medium. In considering the free fall of bodies, Borro claims that a piece of wood descends more swiftly through the air than a piece of lead of equal weight. According to the Aristotelian tradition, this happens because wood is considered to be made up of all four elements (earth, water, air, and fire), but

[58] Camerota and Helbing, 'Galileo and Pisan Aristotelianism', pp. 346–49.

[59] 'quoniam a vacuo natura abhorret, idcirco cum in medio aliquid movetur, simul ad mobilis terga proximi medii partes concurrunt, ut spacium illud impleant, ne derelinquatur inane; hae partes medii prius impulsae, proprio deinde nixu mobile pellunt, et illud ultra promovent, haec quo plures fuerint maiorique nixu pulsae, eo citius et vehementius concurrentis ad terga mobilis illius illud velocius impellunt, ac movent', in Borro, *De motu gravium et levium*, p. 243. The English translation comes from Camerota and Helbing, 'Galileo and Pisan Aristotelianism', p. 349.

mainly of air; that is, air is its dominant constitutive element. Following Averroes's interpretation, Borro held that air had some weight of its own; consequently, a piece of wood that contained more air than a piece of lead would fall more quickly than the lead.

In contrast to Borro, Buonamici rejects the idea of the medium as the thrust behind the body's motion. According to Buonamici, the medium contributes to motion by its resistance. More precisely, with regard to mixed bodies, Buonamici explains that motion takes place because of an agent and also because of two different kinds of resistance that oppose the motion: internal resistance, which occurs because of the different characteristics of the mixed body; and external resistance, which is both the resistance opposed to the agent of motion that causes the body to move in the first place, and the resistance of the medium, the existence of which means the body can move through space. He also rejects the Averroistic thesis that the four elements each have their own weight (even air has weight), stressing that lead was heavier than wood because of its higher density, not the weight of its dominant constitutive element. More precisely, the speed at which a body falls is determined by its heaviness (*gravitas intensive*), and because gravity has a greater pull on lead than on wood, the lead falls more rapidly. Within this framework, Buonamici's theory of acceleration appears complex, but it can be explained quite simply, considering it is grounded principally in the role he attributed to the specific weight (*gravitas species*) and also in the theory of Hipparchus. The first gives the reason for the same rate of fall of two bodies composed of the same matter, but which are different in size and weight (one is bigger than the other). In fact, the speed is determined by the specific weight rather than by the quantity of matter (*pondus*). Instead, the latter helps to inform the acceleration of the body towards the end of its motion. Second, according to Hipparchus, the natural motion increases in speed towards the end because at the beginning of the motion the body is hindered by an external force; this decreases during the motion, whereas the natural motive force of the body is restored and, consequently, the body gains speed. The final cause of the motion is another concomitant factor that explains the acceleration of the body towards the end of its motion: the natural resting place, towards which the body moves, attracts it; this attraction increases when the body is approaching its natural resting place, as does the intensity of the dynamic tendency of the body; consequently, the body moves faster at the end of its motion than at the beginning. This can also be verified by considering the impact when the body hits the ground.

Buonamici's theory is well suited to Aristotelian assumptions; on the contrary, Borro's idea required clarification insofar as it included events that appeared to contrast with the Aristotelian idea of acceleration. In fact, according to Aristotle, the speed of the body increases the closer its proximity to the natural destination defined by its main constitutive element. Therefore, in natural motion, the body moves faster as it approaches the end of its motion, whereas bodies moved by force decelerate towards the end. Conversely, if natural motion is due to antiperistasis, because of the active role played by the medium, it should be the case that bodies move more slowly towards the end of their motion in accordance with their departure from the medium.[60] Therefore, the problem was to explain how the acceleration towards the end of the body's motion could be compatible with the theory of antiperistasis.

Borro's solution relies on the theory of *motor coniunctus*, which postulates that in natural motion there is no separation between the body and the mover. Consequently, according to Aristotle's theory, this generates an increase in speed at the end of the motion:

> in natural motion the mover is always joined to the body, therefore it always moves, and in moving, acquires a greater power, by which the motion becomes swifter at the end. Nor is the mover joined only with the body, but also with the medium, and so it can increase the motion of both, the body and the medium, until the body reaches the end.[61]

[60] Cf. Galluzzi, *Momento*, pp. 309–23.
[61] 'motor naturalis est semper mobile coniunctus ideo mobile semper movet et movendo maiores vires assumit a quibus motus in fine fit velocior: nec tantum mobile, sed etiam medio est motor naturalis semper coniunctus, ideo mobilis et medii motum augere potest, quoad mobile ad finem pervenerit', in Borro, *De motu gravium et levium*, p. 235; english translation by Camerota and Helbing, in 'Galileo and Pisan Aristotelianism', p. 350.

By using the concept of antiperistasis, Borro also explained floating bodies, which occur when a body is immersed in a medium that is heavier than the body itself, for example, wood in water. Once again, Buonamici's theory differs from Borro's assumption. Buonamici explains the buoyancy of bodies as the result of the equilibrium between the upward and downward tendencies of the elements (light and heavy, respectively) that the particular body is composed of:

> in fact we believe that the middle place in between the heavy and the light bodies is appropriate to this kind of bodies, in which they remain and towards which by their nature they move from wherever [...] there is in truth that common end of light and heavy [things] and wherever these bodies are they are impelled to this place, and so they rise among heavy [things], and they fall in truth among light [things] which is the proper place of things which are not simply heavy or [simply] light; and it is necessary that those bodies be so, in which the forces of the elements are equally restrained.[62]

However, it is worth repeating that heaviness has to be considered in terms of the specific weight. For example, because the specific weight of a piece of lead is greater than that of a piece of wood when both hit the water, a piece of wood will float no matter what its weight, whereas a piece of lead will sink, even if it is much lighter than the wood when the latter is immersed in the water.

The theme of floating bodies had already long been debated when Galileo critiqued Buonamici's theory in his *De motu antiquiora*.[63] The controversy between Galileo and Buonamici was concerned principally with the method of determining the specific weight of the bodies and explaining the upward motion of bodies that were immersed in a medium. Whereas Buonamici rejected the hydrostatic thrust theorised by Archimedes, Galileo adopted

[62] 'Namque eiusmodi corporum generi convenire putamus medium inter gravia leviaque locum in quo maneant, et ad quem undecunque suapte natura ferantur […] est vero terminus ille gravium leviumque communis et ubicunque sint ea corpora huc concitantur; itaque in gravibus ascendunt, descendunt vero in levibus qui locus est eorum proprius quae non sunt gravia simpliciter, aut levia, qualia necesse est illa sint, in quibus elementorum exuperantiae sunt ex aequo refactae.', in Buonamici, *De motu*, IV, 24, p. 384 G.

[63] William R. J. Shea, 'Galileo's discourse on floating bodies: Archimedean and Aristotelian elements', *International congress of the history of science*, 12 (1968), pp. 149–53; Assunta De Salvo, *Un paradosso di Galileo. Una chiave di lettura della disputa idrostatica* (Pisa: ETS, 2010).

the Archimedean principle and deduced from it that the upward motion of a body immersed in a medium was due exclusively to the action of the medium, thus denying the existence of light bodies per se. According to Galileo, only heavy bodies existed in nature, and the upward motion of those bodies the Aristotelians defined as 'light' occurred by extrusion (*per extrusionem*), that is, when the body was subjected to a hydrostatic thrust greater than its own weight, that is, its specific weight.

Galileo's theory of extrusion refers to the theory of *motor coniunctus* to explain the ascending motion of the body and its increase in speed.[64] It has already been pointed out that the speed is expected to decrease rather than increase if the acceleration is caused by the medium in which the body is moving. In fact, the motion caused by extrusion was considered by opponents of this theory to be a violent motion. Borro's theory effectively rejected their objections, demonstrating that it must not be considered an enforced but a natural motion.

More interestingly, Galileo also attacked Buonamici's position in his work published in 1612 entitled *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono* (Discourse on Bodies that Stay atop Water, or Move in It).[65] In this book, Galileo revises some of the theory supported in his previous writings, theorising new principles that explain the buoyancy of bodies more correctly. It is unnecessary to linger on his achievements; however, there are a few things worth mentioning here because they illustrate the widespread nature of

[64] Camerota and Helbing, 'Galileo and the Pisa Aristotelianism', pp. 352–57.

[65] For Galileo's *Discorso al Serenissimo Don Cosimo II, Gran Duca di Toscana, Intorno alle cose che stanno in su l'Acqua, o che in quella si muovono di Galileo Galilei*, see Galileo Galilei, *Opere di Galileo Galilei*, Edizione Nazionale ed. by A. Favaro, 20 vols. (Florence: Giunti Barbera, 1890–1909), IV, pp. 57–141 [hereafter cited as OG]. For the English translation, see Galileo Galilei, *Collected Works of Galileo Galilei* (Hastings: Delphi Classics, 2017), pp. 328–565. In this volume, the translation of Galileo's *Discourse on Floating Bodies* is by Thomas Salusbury. For details on the origin of the dispute concerning the bodies in water, see in particular Michele Camerota, 'I *De motu antiquiora* di Galileo e il *Discorso idrostatico* del 1612. Affinità e differenze', *Annali della Facoltà di scienze della formazione dell'Università di Cagliari* 23 (2000), pp. 75–98 and the bibliography indicated by Camerota.

the debates about bodies in water perfectly and, thus, provide further information relevant to help deduce Tassoni's reasoning with regard to the motion of heavy and light bodies.

The dispute about floating bodies at the core of Galileo's *Discorso* originated in 1611 when Galileo met a group of literati, probably in the house of Filippo Salviati (1583–1614) in Florence.[66] The starting point of the debate was a reflection on the four characteristics of bodies. One of the discussants, Vincenzo di Grazia, who was a professor of philosophy, supported the theory according to which cold condenses things. He illustrated this by using the example of ice, stressing that it was the result of cold freezing the water. Galileo opposed this position by pointing out that ice floated on water because it was less dense (that is, rarefied) and, therefore, lighter than the water:

> I say that finding myself last summer in conversation with [certain] learned men, it was said in our discussion that Condensation was a property of cold, and the example of ice was used. I then said, that I would have thought ice was rather rarefied than condensed water because Condensation causes decrease of mass and increase of gravity, and rarefaction causes greater lightness and increase of mass: and when water freezes, its mass increases, and the ice thereby made is lighter than the Water on which it floats.[67]

From this point onwards, the theme of floating bodies became the focus of the polemic. Indeed, Di Grazia tried to explain that ice floated on water by emphasising the role played by its shape: according to him, the ice floated because of its broad, flat shape that was a result of the freezing process. This new shape would make the body unable to plough through the water and encounter its resistance. Conversely, Galileo denied that the shape of a body had anything to do with its buoyancy because of the Archimedean hydrostatic principle, which he had

[66] For more details on the information here reported, see Cf. Stillman Drake, 'The Dispute over Bodies in Water', in *Galileo Studies. Personality, Tradition and Revolution* by S. Drake (Ann Arbor, MI: University of Michigan Press, *c.*1970), pp. 159–76; William R. Shea, *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono* (Florence: G. Barbèra, 1967).

[67] 'Dico che trovandomi la state passata in conversazione di letterati, fu detto nel ragionamento, il condensare esser proprietà del freddo, e fu addotto l'esempio del ghiaccio. Allora io dissi che avrei creduto più tosto il ghiaccio esser acqua rarefatta, che condensata; poi che la condensazione partorisce diminuzion di mole e augumento di gravità, e la rarefazione maggior leggerezza, e augumento di mole, e l'acqua nel ghiacciarsi cresce di mole, e 'l ghiaccio già fatto è più leggero dell'acqua, standovi a galla', in Galileo, OG, IV, p. 65.

embraced from early on, as we have already seen: the ice floats because of its lesser specific weight compared with the greater specific weight of the medium in which it floats (the water) and not because of the resistance of the medium. Galileo also strongly rejected his opponent's argument because he noted that the ice returned to float even after being forcibly pushed under the water, thus penetrating and breaking its resistance. Nevertheless, in the controversy of floating bodies, the role played by the shape was also supported by other Tuscan Aristotelians such as Giorgio Coresio, Arturo Pannocchieschi d'Elci, Flaminio Papazzoni, and Lodovico delle Colombe.[68] The debate was conducted in different phases before it turned to written exchanges. It also expanded; for example, samples of different materials were considered to try and understand more broadly whether the shape affected the buoyancy of objects in water and their speed of movement. Galileo maintained his point, according to which differences in the shape of solid bodies made of the same material, whatever that may be, did not affect their buoyancy, and he also introduced further evidence to silence his opponents. For example, Lodovico delle Colombe demonstrated that a thin wafer of ebony did not sink, although a small ball of ebony sank straight to the bottom when immersed in water. Galileo explained that this was not due to the shape or size of the body; rather, the difference in buoyancy was determined by the fact that the thin wafer of ebony, which was only floating on the water, was still in contact with the air above it. The density of the air combined with the density of the thin wafer of ebony was less than the density of the water. Therefore, the thin wafer of ebony floated on the water:

> But to be in water implies to be placed in the water […] to be placed, means to be enveloped by the ambient body, therefore, then shall the two figures be in the water, when the water shall embrace and envelop them: but when the adversaries show the board of ebony not descending to the bottom, they put it not into the water, but upon the water; where, by a certain impediment […] it is retained, it is embraced, part with water, and part

[68] Cf. Stillman Drake, 'Galileo Gleanings, VIII: The Origin of Galileo's Book on Floating Bodies and the Question of the Unknown Academician', *Isis*, 51 (1960), pp. 56–63.

> by air, which thing is contrary to our agreement, [for] that was that the bodies should be in the water, and not part in the water, and part in the air.[69]

However, if the thin wafer of ebony were to be considered in its pure materiality, devoid of the surrounding air (that is, when the body is immersed in water, it is completely wet), then it would be heavier than the water:

> therefore, you must remove that air, which being conjoined with the board, makes it become another body less heavy than the water, and put only the ebony into the water and you shall certainly see that the board descends to the bottom; and if that does not happen, you are right. And to separate the air from the ebony, all that needs to be done is wet the surface of the said board with the same water: for the water being thus interposed between the board and the air, the other surrounding water shall run together without any impediment, and shall receive into it just bare ebony, as was expected.[70]

Therefore, the assumption that a body whose specific weight is greater than that of water will sink cannot be invalidated:

> It remains most true, therefore, as we have said before, that this so succeeds, for that which in such manner is put on to the water, not the same body that is put into the water: because this which is put *into* the water is the pure board of ebony, which because it is heavier than the water, sinketh, and that which is put *on to* the water is a composition of ebony and of so such air that both together are specifically less heavy than the water and, therefore, they do not descend.[71]

In 1612, only two months after Galileo's publication of his *Discorso*, the anonymous *Considerazioni sopra il discorso del Sig.Galileo Galilei intorno alle cose, che stanno in sù l'Acqua, o che in quella si muovono. Fatte a difesa, e dichiarazione dell'opinione d'Aristotile da Accademico Ignoto* appeared. It was followed by Giorgio Coresio's *Operetta intorno al*

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[69] 'Ma l'esser nell'acqua vuol dire esser locato nell'acqua […] esser locato importa esser circondato dalla superficie del corpo ambiente: adunque allora saranno le due figure nell'acqua, quando la superficie dell'acqua le abbraccerà e circonderà. Ma quando gli avversari mostrano la tavoletta d'ebano non discendente al fondo, non la pongono nell'acqua, ma sopra l'acqua, dove, da certo impedimento […] ritenuta, resta parte circondata dall'acqua e parte dall'aria; la qual cosa è contraria al nostro convenuto, che fu che i corpi debbano essere nell'acqua, e non parte in acqua e parte in aria', in Galileo, OG, IV, pp. 94–95.

[70] 'però rimovete quell'aria, la quale, congiunta con la tavoletta, la fa diventare un altro corpo men grave dell'acqua, e ponete nell'acqua il semplice ebano: chè certamente voi vedrete la tavoletta scendere al fondo; e se ciò non succede, avrete vinto la lite. E per separare l'aria dall'ebano, non ci vuole altro che sottilmente bagnar con la medesima acqua la superficie di essa tavoletta, perché, interposta così l'acqua tra la tavola e l'aria, l'altr'acqua circonfusa scorrerà senza intoppo, e riceverà in sé, come conviene, il solo e semplice ebano', in Galileo, OG, IV, pp. 99.

[71] Galileo, *Discorso*, p. 466. Cf. Galileo, OG, IV, p. 108.

galleggiare de' corpi solidi, and Lodovico delle Colombe's *Discorso apologetico di Lodovico delle Colombe, d'intorno al discorso di Galileo Galilei, circa le cose, che stanno sù l'acqua, ò che in quella si muouono*. Other writings focusing on the dispute about floating bodies appeared in the following years. In 1615, Benedetto Castelli published the *Risposta alle opposizioni del s. Lodovico delle Colombe e del s. Vincenzio di Grazia, contro al trattato del sig. Galileo Galilei, delle cose che stanno sù l'acqua, ò che in quella si muovono. Nella quale si contengono molte considerazioni filosofiche remote dalle vulgate opinioni alle opposizioni di L. delle Colombe e V. di Grazia*.[72] For reasons of space, it is not possible to keep referring to the ideas of these figures, but even the limited attention given to the Tuscan scene is helpful in interpreting Tassoni's *quesito*. It is clear that the debate about floating bodies spread outside academia and that through the voices of the thinkers engaged with the scientific debates about the motion of the elements in general, it assumed a variety of facets in the light of which the differences between the various positions acquired more clarity. The context of a discussion can change, but the nucleus remains the same, and the debate in question must be situated in the context of the considerable uncertainty surrounding Aristotelian physics that emerged in a period during which, on the one hand, the renewal of Aristotelianism was guaranteed because of the appearance of translations of and commentaries on Aristotle's texts, especially those by Neoplatonic commentators, and on the other, confusion also spread because of the different interpretations of Aristotle's doctrine.[73] Tassoni felt this uncertainty himself, and tried to find his own way of understanding the natural processes better.

[72] For information about these books, see Francesco P. De Ceglia, *De natantibus. Una disputa ai confini tra filosofia e matematica nella Toscana medicea, 1611-1615* (Bari: G. Laterza, 1999).
[73] E. Grant, 'Ways to interpret the terms 'Aristotelian' and 'Aristotelianism' in Medieval and Renaissance Physics', *History of science*, 25 (1987), pp. 336-358; Charles H. Lohr, 'Renaissance Authors', in *Latin Aristotle's Commentaries* (Florence, L.S. Olschki, 1988−2010), vol. 2; Charles B. Schmitt, *Problemi dell'aristotelismo rinascimentale*, transl. by Antonio Gargano (Naples: Bibliopolis, 1985); Bianchi, Luca, 'Una caduta senza declino? Considerazioni sulla crisi dell'Aristotelismo fra Rinascimento ed età moderna', in *Aristotelica et Lulliana. Magistro doctissimo Charles H. Lohr septuagesimum annum feliciter agenti dedicata*, ed. by Fernando Dominguez et al., (Steenbrugis: Abbatia S. Petri, 1995), pp. 181-222.

It may not be a coincidence that at the very time these works were being published, Tassoni's *quesito* on rectilinear motion appears to have been considerably expanded from the way it appeared in the 1608 edition of the *Pensieri diversi*.[74] In the 1608 edition, the topic of rectilinear motion is addressed in a concise fashion: it is entirely focused on the basic characteristics of bodies and their reciprocal interactions and functions with the aim of invalidating the idea that heaviness and lightness are the first principles of rectilinear motion. Tassoni, indeed, stressed that the lightness and heaviness of bodies are derived from the action of heat and cold and these, therefore, must be the principles behind the downward or upward motion of objects. In the 1612 edition of the *Pensieri diversi*, this theoretical claim appears to be not only more strongly supported by references principally from Aristotle and Plutarch, which were omitted from the 1608 edition, but also enriched by relevant examples that recall the more recent debates of the time about floating bodies:

> To make sure that what I say is true, let us take a fifty-pound wooden ball and a four-pound iron plate that is neither very thin nor curved nor all the same, and let us throw the ball forcefully into deep water and let us put the iron plate gently in the water; and we will see that, with all the disadvantage of its shape and violent motion, the ball will float in the water and the iron plate, even though it is so much lighter, will sink. I know that porous materials are supported by air; but cold is what removes porosity. Nor does ebony sink for any other [reason] than because of the density that gives it predominance of earth, which is cold.[75]

Tassoni considers a plug of wood that re-emerges even after being forcibly pushed into water, and compares it with a thin plate of irregularly shaped iron that is much lighter than the plug of wood and that sinks despite being placed gently on the surface of the water. The objects selected by Tassoni for this example seem to represent all the characteristics that should be

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[74] Alessandro Tassoni, *Parte de' quesiti del Sig. Alessandro Tassoni dati alla luce da Giulian Cassiani, e dedicati agli illustriss[imi] signori Accademici della Crusca* (Modena: Giulian Cassiani, 1608).

[75] 'Che ciò ch'io dico sia vero, piglisi una palla di legno di cinquanta libre e una piastra di ferro di quattro che non sia curva né molto sottile né tutta eguale, e gittisi con impeto la palla in un profondo d'acqua e la piastra del ferro vi si metta piano; e vedrassi che, con tutto il disavvantaggio della figura e del moto violento, la palla si reggerà sopra l'acqua e la piastra, tutto che men grave di tanto, andrà a fondo. So che le materie porose sono sostenute dall'aria; ma il freddo è quello che leva la porosità. Né per altro l'ebano affonda che per la densità che gli dà il predominio della terra, che è fredda', in Tassoni, *Pensieri*, I, 3, p. 387.

involved when considering the behaviour of a body: the matter, the shape, the kind of motion, the size, and the weight. Therefore, it is possible to use the behaviour of these characteristics to identify the motive agents accurately. However, a clarification is needed: Tassoni is not investigating the buoyancy of the bodies, nor did he develop a concept of specific weight; he simply provides a new reading of the Aristotelian principles of motion that can withstand criticism when rejecting the Peripatetic creed at a time when debates on this theme were widespread. His interpretation shows that heavy things can move upward as much as light things can move downward; therefore, the Aristotelian theory needed to be revised. With this aim in mind, Tassoni emphasised the consequential link between cold/heat and heaviness/lightness: the downward motion of a body, which in this case corresponds to the sinking of the iron is, therefore, due to the cold, which when predominant in an object makes it dense and inclined to a descending motion, as happened in the case of the ebony mentioned above. Following the same line of argument, Tassoni adds another example to the 1612 edition of the *Pensieri diversi* to reinforce the theory of heat as the motive force of a body. He compares the behaviour of a heavy lump of saltpetre (half a pound in weight) and a light feather, both lying on a flat surface, and shows that the heavy body, which is made lighter by heat, moves upward, whereas the feather, despite being by its very nature a light body, lies still in the absence of heat:

> place a very light feather and a rocket of saltpetre powder weighing half a pound, and, having positioned both at the same level, ignite the rocket and it will be seen that the heavier body will rise up and the lighter one will not move from the ground. This is a clear indication that these movements are not caused by weight nor by lightness, but by heat and cold, one [heat] by itself and the other [cold] by accident, as will be shown.[76]

[76] 'piglisi una leggierissima piuma e un razzo di polvere di salnitro di mezza libra di peso e, posto l'uno e l'altro in piano, accendasi il razzo e vedrassi che'l corpo più grave si leverà in alto e il più leggiero non si moverà di terra. Indizio manifesto che questi movimenti non cagionino loro il grave né il leggiero, ma il caldo e'l freddo: l'uno per se stesso e l'altro per accidente, come si mostrerà', in Tassoni, *Pensieri*, I, 3, p. 387. For more details about heat and cold as principles of motion, see Tassoni, *Pensieri*, I, 5. *Se il freddo muova* (Whether the cold can generate motion), pp. 389–92; Tassoni, *Pensieri*, III, 11. *Se il calore sia sostanza o accidente* (Whether heat is a substance or an accident), pp. 471–73.

Slowly but surely, Tassoni's notion of heat and cold as the principles behind motion and rest assumes a more defined profile, becoming the key to interpreting his entire natural philosophy: heat and cold, from which *levitas* and *gravitas* are derived, become the real causes of motion and rest for everything that exists, including animate bodies:

> That finally heat is the true and primary cause of lightness and motion and that cold [is the true and primary cause] of weight and stillness can be seen clearly in the bodies of animals, which, once dead, lose motion and become heavier than [when they were] alive because, after they die, their heat leaves them together with their soul.[77]

More precisely, heat is the principle according to which any kind of motion occurs, both in the terrestrial region and in the heavens. This means that the behaviour of a body in motion (for example, its duration and its speed) depends on the heat pertaining to the matter that the body is comprised of. This is at the root of the differences between the motion that occurs in the terrestrial region and the motion of the heavens. The circular motion of the heavens is considered in Section 3.3.

3.3 Circular motion

Motion of the heavens

Circular motion is the only kind of perpetual motion; it never stops and pertains exclusively to the heavens.[78] Against the background of Tassoni's natural philosophy, the celestial region is the place where the influence of heat, namely, its capacity to generate motion, finds the clearest expression. Tassoni writes:

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[77] 'Che finalmente il calore sia la cagion vera e prima della leggierezza e del moto, e'l freddo della gravità e della quiete, si può veder manifesto ne' corpi degli animali, i quali, morti, perdono il movimento e pesano più che vivi perché morendo gli abbandona il calore insieme con l'anima', in Tassoni, *Pensieri*, I, 3, p. 388.
[78] Cf. Aristotle, *Physics*, VIII, 8–9; Aristotle, *On the Heavens* I, 2; II, 3–8.

> But heat, according to us, except for divine virtue does not need to be moved by an external thing, moving by its own nature without being moved, as is seen in fire. And therefore, the heavens, which have in themselves such a principle, move by themselves.[79]

Consequently, if motion occurs because of heat, once the heavens are conceived of as inherently hot, it clearly follows they are characterised by perpetual motion.

With this in mind, Tassoni's strictly naturalistic approach is evident. As far as he was concerned, there was no need to investigate further any other movers of the heavens, or to assume metaphysical entities were responsible for the motion of the heavens as the Aristotelian tradition suggested; the perpetual motion of the heavens was caused by the heat that characterised the matter the celestial region was comprised of. It is no coincidence that the notion of the heavens as intrinsically hot reinforces the link between Tassoni and Italian naturalism and, in particular, his affinity with Telesian ideas. As I will show, even though Tassoni's thinking diverges from the Telesian system, at this level the similarities between the two are undeniable. The analysis of Tassoni's theories suggests that not only does he draw widely from Telesio, but also adopts Telesian reasoning even when he does not explicitly mention his source. In actual fact, the whole theoretical nucleus around which Tassoni builds his doctrines on natural philosophy seems to follow the path that Telesio created.

With regard to the perpetual motion of the heavens, Telesio stressed that perpetual motion pertains only to the heavens because they are inherently hot, and motion is generated by heat:

> The heavens, then, move because they are hot and fiery, and motion (as has often been said) is the operation proper to fire, by which fire is delighted and preserved. In addition, it [fire] moves with circular motion because only by this [kind of motion] can it move perpetually, never stopping, in a very uniform way and upon itself, so that no part of it ever approaches the Earth more than the other parts.[80]

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[79] 'Ma il calore posto da noi, eccettuata la divina virtù, non ha bisogno di esser mosso da cosa esterna, movendo egli per sua natura senza esser mosso, come si vede nel fuoco. E però il cielo, che ha in se stesso un siffatto principio si muove da sé', in Tassoni, *Pensieri*, II, 2, p. 410.

[80] 'Propterea igitur movetur Coelum quod calidum igneumque est, et motus, ut saepe dictum est, propria est ignis operatio, qua et oblectatur et servatus ignis. Circulari porro movetur motu, quod eo solo perenni nihilque cessante unquam et summe uniformi et in se ipso moveri potest, nihil ulla eius parte Terrae unquam proximius factum', in

In other words, the heavens can only move perpetually because heat is their main characteristic.

In *quesito* 1 of Book 2 of the *Pensieri diversi*, *Che sia il primo motor de' cieli* (What the prime mover of the heavens is), following Telesio's assumption that heat is intrinsic to the heavens, Tassoni contrasts the Aristotelian dynamics of celestial motion with his own thinking, which is in line with Telesio's arguments. The celestial matter, which was called ether, was conceived by Aristotle as a substance completely different from the sublunary elements: it was a solid, crystalline, and unalterable matter, and not one of the features of the different type of matter found in the terrestrial region could be found in the heavens.[81] Consequently, the heavens were also devoid of heat. According to Tassoni, it was exactly this lack of heat that made it impossible for Aristotle to grasp the internal and innate principle of motion, making the theorisation of an external, separate, and immovable prime mover necessary. However, it is easy to demonstrate that this theorisation of an immovable mover is inconsistent even within the Aristotelian framework itself.

Similar to Telesio, Tassoni aims to invalidate Aristotle's assumptions by echoing some aspects of Aristotelian philosophy that would actually confirm the idea of an internal principle of motion. To do so, Tassoni must employ a strategy that does not simply emphasise his distance from Aristotle but also, and more importantly, undermines Aristotelianism from the inside. Such a strategy will demonstrate that Aristotle himself did not deny that the heavens were hot and that they moved by virtue of their intrinsic heat.

The first piece of evidence that Aristotle himself rejects the idea of a separate mover of the heavens and considers the heavens moved because of an internal mover is in Aristotle's *On the Heavens*, where he states,'all natural bodies and magnitudes are capable of moving of

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Bernardino Telesio, *De rerum natura iuxta propria principia, liber primus, et secundus, denuo editi* [1570], *Opuscola* [1570], ed. by Roberto Bondì (Rome: Carocci, 2013), II, 50, p. 174 [hereafter cited as DRN].

[81] Aristotle, *On the Heavens*, I, 2, pp. 15–17.

themselves in space; for nature we have defined as the principle of motion in them'.[82] In fact, if all the natural bodies that can change place by their own volition are considered to have an internal mover, then because the circular motion of the heavens is a change of place motion, it must follow that the heavens are moved by an internal mover.

The second piece of evidence is based on an idea introduced in ancient times, according to which the planets are characterised by a west-to-east motion, whereas the eighth sphere (firmament) moves naturally in the opposite direction (east-to-west motion). This latter movement would affect the planets, generating the different planetary motions that a terrestrial observer can see. The notion will be discussed in more depth in Section 3.4, in which I deal with the motion of the planets; nevertheless, it is used by Tassoni to reinforce the rejection of the external mover of the heavens within the Aristotelian framework. He speaks in terms of functionality within the cosmological system: in a cosmos in which two different types of motion pertaining to the celestial region are accepted (both eastward and westward), an internal and connatural principle of celestial motion would be more convenient so as to avoid the necessity of assuming the existence of more than one prime mover.[83] Indeed, this is Tassoni's focus: if Aristotle accepts both the westward motion of the firmament and the eastward motion of the planets, supposing the prime mover imparts the motion to the firmament only, then there must be another prime mover at the origin of the reverse orientation of the planetary motion. However, this does not appear in the Aristotelian tradition.

The third piece of evidence is based on a Platonic concept, which concerns the interdependent relationship between the human body and the human soul. More precisely, the human soul in the body is compared with the helmsman of a ship, the analogy being employed

[82] Aristotle, *On the Heavens*, I, 2, p. 11. However, it has not been possible to determine which edition of Aristotle's *On the Heavens* was used by Tassoni: 'Omne enim quod naturaliter movetur secundum locum, ab intrinseca natura movetur, quae illi connata est, ut 1. Coeli, text. 5. Caelum naturaliter movetur secundum locum. Ergo ab intrinseca natura, quae est principium motus, et non a separato motore', in Tassoni, *Pensieri*, II, 1, p. 411.
[83] Ibid.

to explain the relationship between the heavens and their agent of motion.[84] Indeed, taken up by Aristotle, this analogy would support the externalism of the mover of the heavens insofar as it suggests that the soul, the principle underlying the motion of human beings, is separated from the human body, in the same way as the helmsman is separated from the ship (similar to the mover of the heavens—according to Aristotle's philosophy the mover is separated from the heavens).[85] Tassoni aims to invalidate this analogy and, therefore, to reinforce the theory of the internal mover of the heavens. In fact, as far as Tassoni is concerned, the soul must be conceived of as the principle underlying the motion of human beings, just as heat is the principle underlying the motion of the celestial matter. In this respect, he brings the readers' attention to a contradiction found when comparing Aristotle's *Physics*, in which the analogy can be glimpsed, with his *On the Soul*:

> I add that the opinion quoted by Aristotle in his favor in text 28 of the eighth [book] of the *Physics* -- that the soul is in the animal as the helmsman is in the ship -- is not true because of what he himself proves in the first and second [books] of *On the Soul*, in which he criticizes a similar manner of speaking, because the soul is in the body as form in matter and not as a separate thing, as the ship [is separate] from the helmsman.[86]

In Aristotle's *On the Soul*, the aforementioned analogy is invalidated by means of another one,[87] which in Tassoni's view correctly reflects the relationship between the soul and the body. Tassoni reports that Aristotle takes the connection between the form and the matter as representative of the relationship between the soul and the body. The former is in and not separate from the latter as is, by contrast, the helmsman with respect to the ship. Therefore, this

[84] Cf. Plato, *Phaedrus*, 245c–246d and 250a–c; *Cratylus*, 400c; *Phaedo* 77b–84a; *Alcibiades* I, 130.
[85] Cf. Aristotle, *Physics*, VIII, 4, pp. 307–09.
[86] 'Aggiungo che l'opinione citata da Aristotele a suo favore nel testo 28. dell'ottavo della *Fisica*: che l'anima sia nell'animale come il nocchiero nella nave, non è vera per quello ch'egli medesimo prova nel 1. e 2. dell'*Anima*, biasimando simil maniera di favellare, poi che l'anima sta nel corpo come forma nella materia e non come cosa separata, come la nave dal nocchiero', in Tassoni, *Pensieri*, II, 1, p. 411.
[87] Cf. Aristotle, *On the Soul* II, in particular pp. 72–81, in Aristotle, *On the Soul, Parva Naturalia, On Breath*, trans. by W. S. Hett, LCL 288 (Cambridge, MA: Harvard University Press, 1957).

second analogy reflects more accurately not only the relationship between the soul and the body but also the similarity between the heavens and heat as inner principles of their motion.

Once again, the similarities between Tassoni's and Telesio's assumptions can be clearly seen. In Book 2, Chapter 54 of *De rerum natura*, Telesio's reasoning with regard to an external mover of bodies is rejected by employing the same analogy to contrast Aristotle with Aristotle himself:

> Rightly, in the same way, [it is said that] animals are moved by the soul, as by a distinct and separate thing which is not in the body in a way very different from that in which the helmsman is in the ship. But, to begin with, it is not at all allowed for Aristotle to think in this way, because elsewhere he disapproves very much of those who think in this way; it does not seem to him that animals are composed of soul and body as of distinct and separate things, but as of form and matter, which, when they come together, seem to merge and become one thing to such an extent that in the whole compound there is nothing to be found that can appear to be one of the two components and not both of them.[88]

Even though Tassoni mentions the Aristotelian texts directly, it is necessary to consider that he might have been referring to Telesio's work; an interesting qualification added by Tassoni to his discourse seems to confirm this. Tassoni wants to make it clear that if heat is the principle underlying the motion of the heavens it can never be separated from them. In fact, the analogy made between celestial heat and the human soul could be misleading. In contrast to heat, the soul can be separated from the body it puts in motion:

> It is true that man can become motionless and, according to our faith, can be divided into the moving part and the moved part, one separated from the other, being different [from each other]: the one is all celestial and the other all elemental. But in the celestial globes [which are] without mixture, contradiction or repulsion, [which are] created of a very pure fire, [and which are] eternal, incombustible, [and] tireless, form finds neither repulsion nor resistance in matter, and the matter [of these celestial globes] has the same tendency as the

[88] 'Recte itidem et animalia ab anima, ut a distincta separataque re, nec valde diverso modo corpori insidente, quam nauta navi movere. At praeter quam quod minime id ponere Aristoteli licet, qui nimirum id ponentes summe alibi damnat, et cui animalia nequaquam ex minima corporeque, ut e distinctis separatisque rebus, sed ut forma et materia constare videntur, quae ubi coeunt ita et ipsi etiam coalescere et unum fieri videntur, ut nihil penitus in composito sit universo, quod alterum modo, aut non utrumque, videri possit', in Telesio, DRN, II, 54, p. 178.

> form, which cannot fall into fatigue nor stillness nor separation, just as it is impossible for heat to ever separate itself from fire at any time.[89]

This excerpt recalls the Telesian conception of celestial matter: matter made of fire characterised by intrinsic heat, the two being inseparable.[90]

In addition, Tassoni's clarification of the possibility of the soul departing from the body has a historical relevance; by means of this notion, Tassoni suggests that he supports the immortality of the soul. In all probability, he wanted to make sure that his discourse would not incur the wrath of the religious authorities. This was understandable, considering that at the end of the sixteenth century the Holy Office had already censored Telesio's book and marked it 'suspended until corrected' (*donec expurgetur*) and, moreover, the relationship between the human soul and the spirit (*spiritus*) established by Telesio had played a role in the verdict.[91] Tassoni was aware of the suspicion aroused by Telesio's books and, without doubt, the materialism and immanentism of Telesio's philosophy, according to which even the soul is a material entity, was hardly adaptable to the spiritualism of the Catholic Church.[92] Instead, Tassoni underlines the divine nature of the human soul in that it transcends the body after death.

Tassoni's intention of showing that his statements were compatible with the Scriptures is even more explicit elsewhere. Indeed, when commenting on the principle of motion, he specifies that by assuming heat is the principle underlying the motion of the heavens, he does

[89] 'Egli è vero che l'uomo può quitarsi e, secondo la fede nostra, dividersi nella parte movente e nella mossa, e separarsi l'una dall'altra, essendo diverse: l'una tutta celeste e l'altra tutta elementale. Ma ne' globi celesti senza mistione, senza contrarietà o ripugnanza, creati d'un purissimo fuoco, eterni, incombustibili, infaticabili, la forma de' quali non truova ripugnanza né resistenza alcuna nella materia e la cui materia ha l'istessa inclinazione che ha la forma, non può cadere né stanchezza né quiete né separazione, come è impossibile che mai in tempo alcuno il calore si separi dal fuoco', in Tassoni, *Pensieri*, II, 1, p. 411.
[90] Cf. Telesio, DRN, I, 13.
[91] For details about Telesio's idea of the soul and the difference between 'soul' and 'spirit', see Leen Spruit, 'Elementi aristotelici e polemica anti-peripatetica nella dottrina dell'anima divina di Telesio', *Verifiche*, 21, 4 (1992), 351–70.
[92] Firpo Luigi, 'Filosofia italiana e controriforma, IV: La proibizione di Telesio', *Rivista di filosofia*, 42, 1 (1951), 30–47. For more information on the censorship of the book, see *L'inquisizione romana e i suoi archivi. A vent'anni dall'apertura dell'ACDF: atti del Convegno, Roma, 15–17 maggio 2018: Memoria fidei*, ed. by Alejandro Cifres (Rome: Gangemi, 2019).

not intend to contrast his thinking with the theologians and metaphysicians who, instead, believe the motion of the heavens to be God's will. It is no coincidence that natural principles such as heat are presented by Tassoni as 'God's ministers':

> God in the creation of the heavens gave them [the heavens] perpetual motion for the generation and preservation of lower things; and to motion he assigned his infallible and immediate principle, which was heat, so that all things that move by themselves or are moved [...] move by virtue of heat.[93]

Going back to the discourse that disagrees with the idea of the prime immovable mover of the heavens being external, Tassoni further supports the idea of an internal mover by pointing out that the noblest creatures are those that are able to move by themselves.[94] Therefore, it must be assumed that the heavens fall into this category; otherwise, Tassoni says, 'If the heavens did not move by themselves, they would be not only more ignoble than a donkey, but [also more ignoble] than quicksilver and than that scum of fire, which [all] move by themselves without external propulsion'.[95]

Hence, by means of the arguments presented by Tassoni it has been shown that he rejects the notion of an external mover of the heavens, but embraces the theory according to which heat is the internal principle underlying the motion of the celestial region. In addition, it has been claimed that the heavens move perpetually precisely because they are hot per se. Furthermore, it has been demonstrated that Tassoni believes this is compatible with suggestions found in Aristotelian books, and that he cannot be accused of violating religious notions because his ideas are based on natural principles of motion that do not exclude the idea of God

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[93] 'Iddio nella creazione de' cieli ordinò loro il moto perpetuo per la generazione e conservazione delle cose inferiori; e al moto assegnò il suo principio infallibile et immediato, che fu il calore, imperciochè tutte le cose che si muovono da sé o sono mosse […] si muovono in virtù del calore', in Tassoni, *Pensieri*, II, 1, p. 409.
[94] Grant, *Planets, Stars, and Orbs*, p. 374.
[95] 'Il cielo non si muovendo da se, verrebbe ad essere non solamente più ignobile di un asino, ma dell'ariento vivo, e di questa feccia di fuoco, che si muovono da loro, senza motore estrinseco', in Tassoni, *Pensieri*, II, 1, p. 411.

as the Creator of the world. This theoretical framework will now be completed with a reflection on the finalism of the perpetual motion of the heavens.

Arguments for the perpetual motion of the heavens

The significance of the perpetual motion of the heavens is at the core of *quesito* 5 of Book 2 of the *Pensieri diversi*: *Perché incessabilmente si muovano i cieli* (Why the heavens move incessantly). According to Tassoni, the aim of the perpetual motion of the celestial realm is the preservation of the universe. The universe is conceived as a whole whose perfection also implies the preservation of the inferior (terrestrial) realm. The characteristics of the latter, such as the sequence of day and night, night and day and the changing seasons of the year, are determined precisely by the perpetual motion of the heavens:

> If the earth is green, if it yields crops, if it gives birth to animals, if plants flourish, if they bloom, if fruit ripens, if the wind blows, if the sea is calm, if the day calls men to work and the night [calls men] to rest, if the grass blooms, if the seed falls, if the fruit sprouts, if the season changes, if heat is tempered, if the frost melts, if animals live, if the world is preserved, everything is the effect of the incessant motion of the heavens and the changing path of the Sun, which, now lengthening and now shortening the days and its heat differently across inhabited areas, causes all these wonderful events as its ends.[96]

For example, without an adequate distribution of heat, which is ensured by the motion of the celestial bodies, some places would be destroyed under the constant effect of excessive solar heat directed at one spot, whereas others that received no heat at all would perish because of the everlasting bitter cold; similarly, plants, fruits, and animals could not exist. These are all considered by Tassoni as ‘marvellous effects’ that would not be produced if the heavens stopped moving.

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[96] ‘Se la terra verdeggia, s’ella produce biade, se partorisce animali, se le piante frondeggiano, se si veston di fiori, se maturano i frutti, se’l vento spira, se il mare s’acqueta, se’l giorno richiama gli uomini alla fatica, se la notte al riposo, se l’erba fiorisce, se’l seme cade, se il frutto spunta, se la stagione varia, se l’arsura si tempera, se si discioglie il gielo, se vivono gli animali, se il mondo si conserva, tutto è effetto dell’incessabil movimento de’ cieli e del vario cammino del sole, che, ora allungando e ora abbreviando i giorni e’l suo calore alle provincie abitate compartendo diversamente, tutti questi mirabili avvenimenti come suoi fini cagiona’, in Tassoni, *Pensieri*, II, 5, p. 421.

By summarising Aristotle's and Telesio's opinions, Tassoni emphasises his distance from both. According to Aristotle, the heavens move perpetually because of their divine nature. Thus, the influence of the divine matter is as eternal as the substance it is comprised of; Aristotle states, 'The activity of a god is immortality, that is, eternal life. Necessarily, therefore, the divine must be in eternal motion. And since the heaven is of this nature (i.e. is a divine body), that is why it has its circular body, which by nature moves forever in a circle'.[97]

Conversely, Telesio disagrees with the Aristotelian view of the divine nature of celestial motion. More precisely, he does not accept the idea that rectilinear and circular motion reflect the difference in terms of the substances that the elemental bodies and the heavens, respectively, are comprised of. In fact, the similarity between the substances of the universe is confirmed by the fact that they cause motion, whether rectilinear or circular:

> no motion is different from or contrary to any [other] motion, but they all constitute one and the same operation, and motions toward opposite places differ from each other for the [same] reason that a stairway or road that leads to opposite places differs from itself. Immobility and non-motion, if one can speak thus, are properly contrary and opposed to motion because, even by Aristotle's own attestation, they derive from a contrary nature, they corrupt motion, are corrupted by motion, and are as different as possible from motion. A rotating body, though capable of moving with all motions, moves only by circular motion and is delighted only by circular motion because only with it, [can it be] joined. Once joined [with circular motion], a rotating body can move perpetually and uniformly in its own place and on itself, and it wants to move only with circular motion, not needing any other motion nor desiring an external motion.[98]

Therefore, the perpetual motion of the heavens is not due to their divine nature but simply to an aim that is internal to themselves: by means of their motion they are simply complying with what their own make-up determines they will do:

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[97] Aristotle, *On the Heavens*, II, 3, p. 149.

[98] 'non scilicet motui ulli ullus vel contrarius est vel diversus motus, sed una eademque operatio omnes, et ad contraria tendentes loca, ea a se ipsis ratione differunt, qua scala a se ipsa differt et via ad contraria loca iter praebens. Immobilitas et immotio, si dicere liceat, vere motui contraria est oppositaque, a contraria vel Aristotelis testimonio manans natura et motum corrumpens et corrupta a motu et quam longissime a motu dissidens. Omnibus porro quod circumfertur corpus motibus moveri aptum, solo circulari movetur et circulari solo moveri gaudet, quod eo solosibi ipsi unitum collectumque perenni atque uniformi in proprio loco et in se ipso moveri potest, eoque solo moveri vult nullo indigens neque appetens externum ullu.', in Telesio, *DRN*, I, 40, p. 60.

> They [the Peripatetics], in fact, seek an efficient and final cause of its [the heavens'] motion other than the nature and character of the heavens because it does not seem to them that motion is the proper operation of the heavens or that it results from its own substance. It must be held, therefore, that the heavens move, not by the impulse or appetite of some external thing, but by the fact that motion is its own operation, by which it [the heaven] is delighted and preserved.[99]

However, Telesio's conclusion, as it is interpreted by Tassoni, is considered reductive: the reason behind the perpetual motion of the heavens goes far beyond their own personal aim. As we have seen, that reason is the preservation of the universe. If the motion of the heavens ceased, then the universe would perish. Certainly, a consideration of the universal good is part of Telesio's reflection on the perpetual motion of the heavens, but he differs from Tassoni in that he considers the preservation of the universe as a secondary result of the prime and real aim of heavenly motion:

> So that, even if it appeared that the things which are between the heavens and the Earth are all constituted and preserved by the motion of the heavens, it should not, however, be held that the heavens move for them; on the contrary, this is a particular indication of the wisdom of most excellent God, who determined that the heavens, moved necessarily and for themselves, are carried in such a way that, although being (as has been said) far larger and stronger than the Earth, they do not burn the Earth which is much smaller and weaker, and from which very numerous and very beautiful things are derived; nevertheless the heavens would not move for them [the things between the heavens and the Earth] if the motion were not necessary, healthy and also very pleasant for the heavens themselves, and if they were not delighted and preserved by the motion as by its proper operation.[100]

On the other hand, Tassoni states that his position does not mean he denies the perfection of the heavens. He rejects the tenet according to which the aim to be achieved must be superior to the agent working for its achievement, and provides the example of the man who works to

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[99] 'Propterea enim aliam a Coeli natura ingenioque et efficientem et finale eius motus causam inquirunt, quod nec propria Coeli operatio, nec a propria eius substantia manare videtur motus. Non igitur ob impulsum, nec ob alicuius externi appetitum, sed propterea moveri statuendum est quod motus propria ipsius operatio sit, qua et oblectatur et servatur Coelum', in Telesio, DRN, II, 59, p. 191.

[100] 'ut si quae in Coeli Terraque existunt medio ab illius motu omnia constitui servarique videantur, minime tamen eorum gratia Coelum moveri existimare licet. Quin potius praecipuum Dei Optimi Maximi sapientiae indicium id sit, qui necessario et sui ipsius gratia motum Coelum eo ipsum deferri instituit modo, ut longe etiam maximum longeque (ut dictum est) robustissimus, Terram tamen longe minorem longeque debiliorem non exurat, et longe plurima ex ea educat longeque pulcherrima, at quorum gratia tamen nunquam moveatur Coelum, nisi necessarius salutarisque et longe etiam iucundissimus sit ipsi motus, quove ut propria oblectetur serveturque operatione', in Telesio, DRN, II, 59, p. 192.

obtain food: the food is not nobler than the man himself. In addition, by using this example, which concerns human behaviour, Tassoni reiterates his position with regard to the motion of the heavens: the ultimate reason for a man to obtain food and clothing is actually the preservation of his life; similarly, the perpetual motion of the heavens is aimed at preserving the universe: 'we shall say that even the movement of the heavens is not simply to preserve earthly things, but the union and perfection of the universe, which would be lacking if these things were missing'.[101] Therefore, Tassoni considers the perpetual motion of the heavens as 'God's manifestation and the display of his eternal providence',[102] which, because it assigns perpetual motion to the heavens, guarantees those effects that are aimed at the preservation of the universe and its perfection. With this in mind, the consideration of the circular motion of the heavens is fully explained within the theoretical framework of Tassoni's natural philosophy.

3.4 Mechanics, Cosmology, Planetary motions

Venus, Mercury, and the Sun: on the speed of the celestial bodies

The cause and purpose of the perpetual motion of the heavens, as they are thematised by Tassoni, have been presented in Section 3.3: because the celestial matter is inherently hot, the heavens move perpetually, the aim being to preserve the universe. The way in which Tassoni conceives the world system will be the focus of Chapters 4 and 5, in which I will consider the structure of the cosmos and the functioning of the world systems proposed in the early modern era. However, in light of the principles established, it is already possible in this section to bring to light some considerations with regard to celestial mechanics and cosmology. These concern the following question: What impact did Tassoni's ideas have at an astronomical level?

[101] 'diremo ch'eziandio il movimento de' cieli non sia per conservar semplicemente le cose terrene, ma l'unione e la perfezione dell'universo, che mancherebbe, se queste cose mancassero', in Tassoni, *Pensieri*, II, 5, p. 421.
[102] Tassoni, *Pensieri*, II, 5, p. 420.

Tassoni himself enriches his discourse about celestial motion with some suggestions that are closely related to 'mechanical thinking'.[103] These appear in *quesito* 2 of Book 2 of the *Pensieri diversi*: *Se le parti del cielo più calde si muovano più velocemente* (Whether the hottest parts of the heavens move faster).

On the basis of what has been said with regard to heat as the underlying principle of motion, it is reasonable to assume that the heat inherent in a body also determines the velocity of its motion; therefore, the hotter parts of the heavens should move faster than those that are cooler. Experience, however, seems to contradict this assumption. As Tassoni points out, the Sun, which is the hottest celestial body, does not appear to move faster, 'varying little compared with the motion of Venus and Mercury'.[104] Tassoni's claim is rooted in the observations of planetary motion made by the early astronomers and widely known since antiquity.

For centuries, the world system based on concentric spheres had been the most popular explanation of planetary motion and the positions of the planets.[105] It was thought that the planets were situated in an area between the sphere of the fixed stars and the sphere of the Earth, which occupied the centre of the world. Immediately after the sphere of the fixed stars came Saturn, followed by Jupiter and Mars, and then, in sequence, the Sun, Venus, and Mercury. However, the precise position of these last three was hard to define in relation to their periods of revolution around the Earth. Indeed, they all appeared to take the same amount of time to complete their revolutions, that is, one year. The Moon's orbit was thought to be the closest to the Earth. Naturally, such a model was a simplification that did not allow for the correct interpretation of the irregularity of planetary motion. Nonetheless, it was accepted for centuries, especially among intellectuals who were not familiar with mathematics, the

[103] Massimo Bucciantini, Michele Camerota, and Sophie Roux, *Mechanics and Cosmology in the Medieval and Early Modern Period* (Florence: Olschki, 2007).
[104] Cf. Tassoni, *Pensieri*, II, 2, p. 412.
[105] Michel-Pierre Lerner, *Le monde des sphères*, 2 vols. (Paris: Les belles lettres, 2008).

discipline that allowed astronomers to rise to new achievements and to interpret the movement of the planets more accurately.

Mathematical calculations, based on systematic observations, played a fundamental role in the creation of interpretative schemes for understanding the dynamics of the celestial bodies. The divide between mathematics and natural philosophy was increasingly being perceived as untenable, and bridging it was necessary for the assessment of a new cosmological view. A sense of crisis with regard to the divide between the disciplines was strongly felt by Copernicus, who in his *De revolutionibus orbium celestium* (1543) proposed and presented a new heliocentric astronomical system. However, reconciling the two is an achievement of more modern times. Before this new arrangement of the planets could be discovered and presented as a physical model of the cosmos, for a long time, various proposals tried to explain the apparent motion of the planets according to a strictly geocentric view. In antiquity, one of the most highly successful theories was devised by Eudoxus of Cnidus (*c*.390 BC–*c*.337 BC) and is known as the homocentric spheres system.[106] Incorporated by Aristotle into his cosmological model, the theory was able to explain the trajectories of the planets by means of a complex system of (Earth-centred) spheres in which each planet was embedded. Without rejecting only uniform circular motions, the homocentric model provided an explanation for the planetary movements as they appeared to the observer from Earth. The planets were supposed to perform a complex combination of movements: the spheres in which they were embedded had to rotate in the direction opposite to the motion of the sphere of the fixed stars; the retrograde motion was the result. A system such as this, however, made it impossible to provide an explanation for the change in the luminosity of the planets: assuming Earth-centred spheres, the planets

[106] Michel P. Lerner, *Il mondo delle sfere*, pp. 26–30.

would all be the same distance from the Earth and should, therefore, always appear to observers to have the same luminosity.

An alternative system was conceived by Apollonius of Perga (late third to early second century BC) and Hipparchus of Rhodes (*c.*190 BC–*c.*120 BC). Reworked by Ptolemy, this system was based on the deferent (a circle carrying the planet around the Earth) and the epicycle (a small circle carried by the deferent and which carries the planet).[107] It worked very differently from the homocentric spheres system, but was simpler, rejecting the idea that the planets were embedded in solid spheres, and also accurate in that it provided a convincing argument for the apparent retrograde planetary motion as well as an explanation for the apparent variation in the distance of the planets from the Earth. It was the basis of many other planetary arrangements and was accepted until the sixteenth century.

Consequently, it is clear that the expression 'Aristotelian–Ptolemaic system' is somewhat artificial and indicates the combination of those cosmological doctrines, which although fully non-homogeneous, represented the background against which astronomers and, more generally, those intellectuals interested in astronomy tried to understand natural phenomena. This is also Tassoni's aim: he tries to overcome the problems with regard to planetary motion that remained unresolved in the context of these worldviews. As we have seen, Tassoni attempted to explain the motion of the celestial bodies by means of their underlying principle of motion: heat. Telesio had made the same attempt and, indeed, Tassoni's ideas are partially drawn from Telesian notions. Precisely, the issue concerned the position of the Sun, Venus, and Mercury and, in particular, the reason why the Sun, which was surely much hotter than the other two celestial bodies, did not seem to move any faster. The core of the solution proposed is the acceptance of the axial rotation of the Sun.[108] In fact, this idea was first theorised by Plato

[107] Michel P. Lerner, *Il mondo delle sfere*, pp. 83−106.
[108] Michel-Pierre Lerner, 'Sicut nodus in tabula. De la rotation propre du soleil au seizième siècle', *Journal for the History of Astronomy* 11 (1980), 114–29.

in his *Timaeus* and certainly rejected by Aristotle.[109] In this work, Aristotle supported the idea that the matter the heavens are comprised of, the ether, is ontologically different from the four elements (earth, water, air, and fire) of the terrestrial region, and is devoid of heat. Conversely, Plato was of the opinion that the celestial bodies were made up of the four elements, which in his view included all bodies that existed in the universe. Speaking about the foundation of the cosmos, Plato says:

> Now that which has come into existence must needs be of bodily form, visible and tangible; yet without fire nothing could ever become visible, not tangible without some solidity, nor solid without any earth. Hence, in beginning to construct the body of the All, God was making it of fire and earth. But it is not possible that two things alone should be conjoined without a third; for there must needs be some intermediary bond to connect the two […] Thus it was in the midst between fire and earth God set water and air, and having bestowed upon them so far as possible a like ratio one towards another—air being to water as fire to air, and water being to earth as air to water—he joined together and constructed a Heaven visible and tangible.[110]

Tassoni was also well acquainted with Plato, as attested by the explicit reference to Plato's *Timaeus* and the theory of the elemental composition of the heavens in his discussion of the structure of the celestial matter:

> Plato in the *Timaeus* considered the heavens mixed and composed, as well as these inferior things, saying that without earth one could not make a tangible body, nor without fire [a] visible and luminous [body], nor [a] continuous [body] without the other two media. And elsewhere he said that the stars shine because there is a great quantity of fire in their mixture. In this way, he came to compose the celestial bodies of the four purified elements, or at least of matter proportionate to them.[111]

From a Platonic perspective, fire is a characteristic of the celestial bodies and each is endowed with rotary motion around its own axis. Not surprisingly, this idea was taken up by

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[109] See Harold F. Cherniss, *Aristotle's Criticism of Plato and the Academy* (Baltimore: Johns Hopkins University Press, 1944).

[110] Plato, *Timaeus, Critias, Cleitophon, Menexenus, Epistles*. Trans. by R. G. Bury (Cambridge, MA: Harvard University Press, 1999), pp. 59–61.

[111] 'Platone nel *Timeo* fece il cielo misturato e composto, come anche queste cose inferiori, dicendo che senza terra non si poteva far corpo tangibile, né senza fuoco visibile e luminoso, né continuo senza gli altri due mezi. Ed altrove disse che risplendeano le stelle perché nella mistura loro concorrea gran quantità di fuoco. Di maniera ch'egli veniva a comporre i corpi celesti dei quattro elementi purificati o almeno di materia proporzionata a loro', in Tassoni, *Pensieri*, II, 6, p. 422.

those authors of the sixteenth century who were the strongest opponents of Aristotle's natural philosophy, or simply more open to the Platonic tradition. Among the first was Telesio, one of Tassoni's favourite sources.

As already noted in his *De rerum natura* (1570), and in contrast to Aristotle, Telesio supports the idea that motion is caused by heat and, indeed, that the celestial bodies are comprised of a fiery matter. Taking the heavens as the subject of the following statement, Telesio emphasises their hotness: 'it cannot be held at all that it [the heaven] is of a nature different from that of sublunar things, nor that it is entirely incapable of heat, but that it is by far the hottest, as perceived by sense'.[112]

Without assuming the fiery nature of the celestial bodies, Tassoni summarises Telesio's theory and, following him, claims that the velocity of the celestial bodies has to be considered with respect to their rotation around their own axes. In this regard, it can be affirmed that the Sun moves faster than any of the other bodies:

> This doubt was resolved by Telesio, who also had the opinion that the stars were not only hot but also fiery, saying that the speed of the Sun does not consist in the movement that it makes from east to west, nor in that which it seems to make from west to east, because in these [movements] it differs very little from the other planets; but it [the speed of the Sun] consists in that [movement] which it makes by turning like a grindstone with unspeakable speed, as one who looks at it in a mirror or in a basin of water can clearly see.[113]

In Chapter 51, Book 2 of *De rerum natura*, Telesio accepts the idea that the Sun moves faster than the sphere in which it is embedded (despite the fact that he himself had claimed all

[112] 'nequaquam a sublunaribus diversae naturae videri potest, nec calori somnino incapax, at longe calidissimus, cuiusmodi ipso percipitur sensu', in Telesio, DRN, II, 40, p. 153.
[113] 'A questo dubbio soddisfece il Telesio, che ebbe opinion anch'egli che le stelle fossero non solamente calde ma di fuoco, dicendo che la velocità del Sole non consiste nel movimento ch'ei fa d'oriente in occidente né in quello che par ch'ei fa d'occidente in oriente, percioché in questi molto poco si discorda dagli altri pianeti ; ma consiste in quello che ei fa raggirandosi a guisa di mola con indicibile velocità, come da chi lo mira in uno specchio o in un catino d'acqua si può chiaramente vedere', in Tassoni, *Pensieri*, II, 2, p. 412.

the celestial bodies, including the spheres in which they were embedded, were of the same nature):

> it is immediately seen that the Sun moves much faster than the sphere. That is, the Sun is not only carried by the sphere, but it also rotates by itself and with an extremely fast motion, as can be clearly seen not only when it rises and when it sets, but also at noon, when the air becomes rather thick, that is, when the Sun does not dazzle much, but allows [itself] to be observed; and also in water and much more in mirrors placed underwater, and in fact in them [the mirrors] it is always observed very clearly that it rotates with very great speed.[114]

In addition, it seems that Telesio considers the Sun's heat to be particularly fierce and that he recognises the interaction between the poles as an influential factor in the speed of the celestial bodies:

> The parts very close to the poles are not always motionless, all of them being carried and led not only by their own sphere but also by the first [sphere], so that it is seen that not only the other parts of the spheres move, but the very poles of the other spheres move, and therefore the different position of the poles causes the poles themselves and parts closer to them, which need a faster motion than the one which is proper to them, to move faster.[115]

Although Telesio's position with regard to the motion of the celestial bodies is not absolutely clear, another point relevant to the present analysis emerges from his reasoning, and this helps to understand Tassoni's use of his sources. Telesio still believes in the concentric spheres: the celestial bodies, which are embedded in solid spheres, follow the motion of the heavens. This is particularly important because it demonstrates that at this point Tassoni has broken with Telesian tradition. Indeed, Tassoni rejects the idea that the planets are embedded

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[114] 'iam multo quam orbis velocius moveri videtur Sol; qui nimirum non ab illo modo circumducitur, sed ipse per se et longe quidem rapidissimo circumvolvitur motu, ut non in exoriente tantum illo occidenteque liquido intueri licet, sed in meridiano ubi aer crassiusculus fit, ubi scilicet non valenter visum ferit Sol, sed se inspici sinit; et in aqua, multoque in speculis acquae suppositis magis; manifestissime enim in iis velocissime illum circumvolvi ubivis intuebere', in Telesio, DRN, II, 51, p. 175.

[115] 'Polis proximae partes non usquequaque immobiles, non proprio tantum, sed a primo etiam delatae circumactaeque omnes, ut non reliquae modo orbium partes moveri videantur, sed etiam reliquorum orbium poli, id itaque amplius diversa polorum praestat positio, quod et polos ipsos et proximas polis partes, velociore quam proprius est opus habentes, velociore commovetur motu', Ibid.

in solid spheres, thereby showing an openness towards the concept of the fluidity of the heavens.

It should be borne in mind that the rejection of the celestial spheres notion was combined with the confutation of the Aristotelian doctrine of the immutability of the heavens, an issue that did not much affect Telesio's philosophy. He had already refused to consider the heavens as comprised of a matter ontologically different from that of the terrestrial realm, despite adhering to the idea of the celestial spheres.

The astronomical observations of the late sixteenth century made by people such as Rothmann and Brahe represented the first hard evidence of the possibility of variations within the celestial region, which led to the rejection of the idea of celestial spheres.[116] However, before astronomical events could inflict the decisive blow to Aristotle's idea of the celestial matter, the idea of the quintessential nature of the heavens and their division into spheres had already been questioned by many. Among the figures that could be mentioned here are thinkers such as Giovanni Pontano (1426–1503), Marsilio Ficino (1443–1499), Johannes Ziegler (1480–1549), Jean Pena (1528–1558), Francesco Patrizi (1529–1597), and Roberto Bellarmino (1542–1621).[117] The investigation into unexpected celestial events, therefore, provided the natural philosophers of the time with more ammunition against the notion of solid spheres.

Telesio's adherence to the Aristotelian idea of the relationship between the stars and their spheres was also a reason for concern among those who critically appreciated his philosophy. Francesco Patrizi, indeed, is one such case. As a reader of *De rerum natura* and an admirer of its author, Patrizi criticised some of Telesio's cosmological theories.[118] Among Patrizi's

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[116] I am referring to the appearance in the last decade of the sixteenth century of those celestial phenomena, for example, novae and comets, to which I will dedicate a section in the following chapter. See Chapter 4, Section 4.2: Between the heavens and the Earth: Debates about comets.
[117] Michel-Pierre Lerner, *Tre saggi sulla cosmologia alla fine del Cinquecento* (Naples: Bibliopolis, 1992), especially pp. 75–80.
[118] Patrizi's objections to Telesio can be found in B. Telesio, *Varii de naturalibus rebus libelli*, ed. by L. De Franco (Florence: La Nuova Italia, 1981), pp. 453–97. For more information on Patrizi's criticism of Telesio, see also

criticisms is Telesio's acceptance of the celestial spheres around which the planets rotate. The Aristotelian idea of the relationship between the planets and their spheres is metaphorically and critically referred to by Patrizi in terms of *nodi in tabula*, that is, the planets are embedded in their spheres like knots in a plank of wood. This metaphor applies to all those cosmological schemes in support of the existence of celestial spheres; conversely, Patrizi believes that the planets have an inherent circular motion and that their motion does not occur because they rotate around spheres.[119] The metaphor of the stars in the heavens being like knots in a plank of wood was rejected by Francesco Patrizi in 1572 in opposition to Telesio,[120] and the anti-Aristotelian thinker further restated his views in his *Pancosmia* (1591), in which his ideas on the cosmos are well expressed:

> And thus there does not exist and there has never existed any fixed thing between the heavens and the stars, and the stars are not fixed to the heavens, nor the heavens [fixed] to the stars. And it is not true that the heavens carry with them the fixed stars and make them rotate. And all the philosophers and all the astronomers who taught that the stars are attached to the sky like knots to a plank are completely wrong.[121]

To be fair, Telesio's view on the matter is much more complex, and according to his philosophy, the relationship between the spheres and their planets is not accurately described by Patrizi's metaphor. In the third edition of *De rerum natura* (1586), Telesio tried to explain his position. First, the metaphor does not allow for the understanding that the planets are not just a part of the sphere in which they are embedded and whose motion they follow, but that they also rotate around their own axes. Second, Telesio explains that the relationship between

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Cesare Vasoli, 'Su alcune obiezioni di Francesco Patrizi al Telesio', in *Atti del Convegno internazionale di studi su Bernardino Telesio*, pp. 193–205.

[119] Francisco Patrizi, *Nova de universis philosophia: in qua Aristotelica methodo non per motum sed per lucem & lumina ad primam causam ascenditur* (Ferrara: apud Benedictum Mammarellum, 1591).

[120] See Francesco Fiorentino, *Bernardino Telesio ossia studi storici su l'idea della natura nel Risogimento italiano*, vol 2. (Florence: Le Monnier, 1872-1874), pp. 376–77.

[121] 'Nulla ergo inter coelum et stellas, aut accidit iam olim, aut modo est, fixio. Neque igitur stellae coelo sunt infixae. Neque coelum stellis. Neque coelum stellas sibi fixas gerit, aut circumvolvit. Toto ergo errarunt coelo et Philosophi, et Astronomi omnes, qui stellas coelo fixas, uti nodos tabulis esse docuerunt', in Patrizi, *Pancosmia*, XI, p. 89r, in Francesco Patrizi, *Nova de universis philosophia*. See also Francesco Patrizi, *Nova de universis philosophia. Materiali per un'edizione emendata*, ed. by Anna Laura Puliafito Bleuel (Florence: L.S. Olschki, 1993).

the heat of the sphere and the heat of the planet determines the velocity of the axial rotation of the different celestial bodies; consequently, the Sun moves faster because of its excess of heat compared with the heat in its orb.[122]

Further criticism of Aristotle's system based on planets embedded in solid spheres is found in Campanella's work *Philosophia sensibus demonstrata* (1591):

> It should also be known that Aristotle wrongly denies the motion of the stars when he says that they move like knots in a [wooden] board; for in addition to the motion they gain from the orbit, by which they are dragged, they have another motion, by which they move in their poles circularly; indeed, where the heat is more abundant, there the motion is greater. But in the stars the heat is formed into a ball and therefore it is necessary that they move within themselves faster than their orbits.[123]

Tassoni does not explicitly mention Patrizi or Campanella; in fact, their animistic approach is a long way from Tassoni's conception of the world. However, the main criticism of Aristotle is the same for Tassoni and these philosophers: Aristotle was wrong in denying that the heavens are hot. However, Tassoni does not accept the reality of the celestial spheres. It is precisely in this context that Tassoni distances himself from Telesio. Tassoni rejects Telesio's statements, and their defence by Campanella, and proposes a different solution for the motion of the sun as well as for planetary motion more generally: 'Therefore the Sun moves more quickly than all the stars, not within any poles of its own, because it has no pole, but rotating in itself'.[124] Before presenting Tassoni's thinking, it is worth repeating that the acceptance of the notion of celestial spheres had for centuries explained planetary motion according to diverse geocentric systems of reference, and the use and combination of spheres provided an explanation for the proximity of the Sun to Venus and Mercury. In his *quesito*,

[122] Cf. Michel-Pierre Lerner, *Sicut nodus in tabula*, pp. 118–20.
[123] 'etiam est sciendum quod falso Aristoteles abstulit motum a stellis et moveri sicut nodos in tabula innuit: ipsae enim praeter motum quem habent ab orbe, quo cum deferuntur, alium habent motum, quo in propriis polis moventur circulariter: ubi enim copiosior calor est, ibi maior motus: in stellis autem est conglobatus calor, itaque velocius suis orbibus in se moveri oportuit', Campanella, 'Disputatio tertia', p. 307, in Tommaso Campanella, *Philosophia Sensibus Demonstrata in octo disputationes distincta* (Naples: apud Horatium Salvianum, 1591).
[124] 'Il Sole adunque più di tutte le stelle velocemente si muove, non dentro alcun proprio polo, ch'ei non ha polo, ma in sé stesso girando', in Tassoni, *Pensieri*, II, 2, p. 412.

Tassoni also includes a reflection on cosmological schemes that differ from the traditional Aristotelian–Ptolemaic model. In particular, he refers to the proposals put forward by Alpetragius (twelfth century: †*c.*1205), Marzianus Capella (fourth to fifth centuries), and Copernicus (1473–1543); these, in fact, would seem even more appropriate than the traditional model for explaining the short distances between the bodies mentioned and, thus, the minor differences in terms of their motion and speed.[125]

Briefly, according to Alpetragius (*De motibus celorum*), Venus is placed above the Sun, whereas Mercury is situated below it and, more generally, the motion of the planets, which he believes to be a westward motion, is based on the motion of their poles. Tassoni reports that Telesio's followers grounded their planetary theories in this homocentric model:

> And the Telesians accept this opinion of Alpetragius as true, and some of them explain various aspects of the width and height of the planets by placing the ends of their poles on small circles separated from the poles of the universe. But this desire to make the poles of the heavens, which are imaginary, as real as the spheres of the kitchen which are turned on wheels, is not [a] philosophical [argument].[126]

However, Alpetragius's model is still strictly geocentric. In contrast, Capella (*De nuptiis Mercurii et Philologiae*) held that the motion of Venus and Mercury was centred around the Sun and that they did not rotate around the Earth at all. Consequently, according to Capellian theory, Mercury is closer to the Earth when both Venus and Mercury are set above the Sun and, conversely, when both these planets are below the Sun, Venus appears closer to the Earth. In Chapter 10 of his *De revolutionibus*, Copernicus mentions that both Alpetragius and Capella believe the order of the planets to be different from the classic Ptolemaic models, but

[125] For details about the planetary motion in the cosmological models of Alpetragius, Capella, and Copernicus, see Bruce S. Eastwood, *The Revival of Planetary Astronomy in Carolingian and Post-Carolingian Europe* (Aldershot: Ashgate, 2002).

[126] 'E questa opinion d'Alpetragio i telesiani l'accettano per vera ed alcuni di loro salvano diversi aspetti della latitudine e dell'altezza de' pianeti col porre l'estremità de' lor poli sopra piccoli cerchi separati da' poli dell'universo. Ma questo voler fare i poli del cielo, che sono immaginari, cosa reale, come gli schidoni delle cucine che si voltano sopra ruote, non ha del filosofico', in Tassoni, *Pensieri*, II, 4, p. 418.

considering his reputation rests on the proposal of a new astronomical system that locates the Sun at the centre of the world (heliocentrism), it is not surprising he emphasised the circumsolar pattern proposed by Capella:

> In my judgement, therefore, we should not in the least disregard what was familiar to Martianus Capella, the author of an encyclopedia, and to certain other Latin writers. For according to them, Venus and Mercury revolve around the sun as their center. This is the reason, in their opinion, why these planets diverge no farther from the sun than is permitted by the curvature of their revolutions. For they do not encircle the earth, like the other planets, but have opposite circles. Then what else do these authors mean but that the center of their spheres is near the sun?[127]

What the systems proposed by Alpetragius, Capella, and Copernicus have in common, as we can infer from Tassoni's statement, is that Mercury and Venus rotate around the Sun: 'I add that Alpetragio, Marziano Capella, Copernicus, and others held that Venus and Mercury do not turn under the Sun; from which in this respect they still never find themselves distant from it [the Sun]'.[128]

However, as is well known, Copernicus was the first to theorise a model of the world based entirely on the motion of the Earth and in which the Sun was the centre of all planetary motion.[129] Copernicus assigned three different types of circular motion to the Earth (daily rotation, annual revolution, and the annual tilting of its axis) and by means of a new positioning of the planets, was able to determine the position of Venus and Mercury, thereby explaining their proximity to the Sun. Venus's orbit was believed to be inside the Earth's orbit, whereas Mercury's orbit was inside Venus's orbit. Because Mercury and Venus were situated inside the

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[127] Copernicus, 'On the Revolutions', trans. by Edward Rosen, I, 10, p. 20, in Nicholas Copernicus, *Complete Works*, 2 vols. (Baltimore: The Johns Hopkins University Press, 1992).

[128] 'Aggiungo che Alpetragio, Marziano Capella, il Cupernico et al hanno sostenuto che Venere e Mercurio non si girino sotto il sole; onde per questo rispetto ancora non si ritrovino mai distanti da lui', in Tassoni, *Pensieri*, II, 4, p. 418.

[129] On Copernicus's cosmology, see Alexandre Koyré*, La révolution astronomique. Copernic, Kepler, Borelli* (Paris: Hermann, 1961), pp. 15–73; Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (Cambridge: Harvard University Press, 2002; Owen Gingerich, 'The Copernican Revolution', *in Science and Religion: A Historical Introduction*, ed. by Gary B. Ferngren (Baltimore: The Johns Hopkins University Press, 2002.), pp. 95–104.

orbit of the Earth, they were necessarily closer to the Sun, but they did not accomplish their orbits in the same amount of time. As a whole, the system proposed by Copernicus was no less complex than the Ptolemaic models. There is no need to go into any technical detail, because the way in which Tassoni deals with the topic represents the approach of many professional natural philosophers who did not care for mathematical detail but discussed the cosmological points. In fact, Tassoni himself aimed to understand the concept of the cosmos from a natural philosophical point of view, and his reflections on the theme of motion led him to accept the geocentric system. The epistemological consequences implicit in the acceptance of heliocentrism according to Tassoni's thinking will be the theme of Chapter 5; before addressing this topic, however, Tassoni's view of planetary motion should be explained.

The direction of heavenly motion

It has been said that the system based on concentric spheres was able to explain planetary motion. More precisely, it was assumed that the planets were characterised by a west-to-east motion, whereas the eight spheres moved naturally in the opposite direction (east to west) dragging the planets with them, which created a tension between the motion of the spheres and the individual motion of each planet, so generating the different planetary motions that a terrestrial observer could see.[130] As Tassoni reports, this idea was introduced by Alcmeon, but according to Tassoni, this way of justifying the apparent motion of the planets had to be rejected. Tassoni points out that this idea was in conflict with one of the pillars of the Aristotelian theory of motion, namely, that the movement of the celestial bodies cannot be contrary and violent.[131] As far as Tassoni was concerned, the different directions in which the eight spheres and the planets themselves moved was clearly an application of contrary and

[130] Grant, *Planets, Stars, and Orbs*, pp. 497−98; M. P. Lerner, *Il mondo delle sfere*, pp. 7−106.
[131] Cf. Aristotle, *On the Heavens*, III, 3, in particular pp. 147–51.

violent motion to the heavens, which would cause the destruction of the heavenly harmony. This topic is discussed in *quesito* 4 of Book 2 of the *Pensieri diversi*: *Se i cieli si muovano di contrari moti* (Whether the heavens move by contrary motion).

As one of the supporters of this theory, Tassoni had to face two counter-arguments that apparently validated the theory of the contrary motion of the celestial bodies. First, Tassoni contrasts his theory with that of Alexander of Aphrodisias, who had not considered the east-to-west motion of the planets as a violent motion but, conversely, argued that the planets voluntarily assumed the same direction of movement as the eight spheres to fulfil the good of the universe, in other words, their aim in moving at all. Tassoni points out the inconsistency of such a position. Indeed, he says, if according to Aristotle the planets move naturally from west to east, the movement that drags them in the opposite direction can only be violent and, thus, contrary to their nature.[132] The analogy with the man who is forced to walk in the direction opposite to that in which he has started walking is used to illustrate his point: 'And it would be foolish to think it was not repugnant to my nature to drag me backward towards the west, while I am turned with heart and steps towards the east'.[133] A man who is moving towards the east cannot but feel annoyance if forced towards the west. First, according to Tassoni, it is a weak argument that a man who walks on the deck of a ship in the opposite direction to the travel of the ship itself does not feel anything strange. Tassoni notes that the comparison is not relevant to the case of the celestial bodies because of the different natures of the man and the ship, whereas the stars and the heavens, as Aristotle himself theorised, are made of the same matter and, thus, have the same inclination.

Second, Tassoni opposed the opinion that was grounded in the existence of the sphere of fire, which according to Aristotle was, among the four terrestrial spheres, the one closer to the

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[132] Tassoni, *Pensieri*, II, 4, p. 417

[133] 'E sarebbe pazzia il credere che non fosse ripugnante alla mia natura lo strascinarmi all'indietro verso occidente, mentre io son rivoltato col cuore e co' passi verso oriente', Ibid.

heavens. I will not dwell on this topic because it will be widely addressed in Chapter 4; therefore, I limit myself to reporting the argument that Tassoni believes must be rejected: if the planets were to move in accordance with the sphere of fire they would follow the westward motion, which would be considered not contrary to the nature of celestial bodies but preternatural (*supranaturaliter*). According to Tassoni, this notion was not grounded in Aristotelian theory and the term *supranaturaliter* had never been used by Aristotle, as Antonio Bernardi (1502–1565), mentioned by Tassoni, also noted.[134] Tassoni's use of Antonio Bernardi suggests a peculiar way of adapting Aristotelian philosophy that is representative of Tassoni's approach. In particular, Bernardi aims to retrace what he considered to be the correct nucleus of Aristotelian philosophy undermined by the exegetic tradition. According to Bernardi, the Aristotelian doctrines conveyed by university teachings drew from a tradition that had not preserved the authentic meaning of Aristotle's statements.[135]

After rejecting the possibility of finding movements that were contrary to each other in the heavens, Tassoni then approved the ancient idea theorised by Anaxagoras, Democritus, and Cleanthes, and proposed a system that shows points of convergence with Alpetragius's doctrine of motion. Indeed, these philosophers recognise only the westward motion of the heavens: all the celestial bodies move towards the west, in the same direction as the firmament. Within Alpetragius's theoretical framework, the prime mover, that is, the ninth sphere, moves all the bodies equally, from the sphere of the fixed stars to the elements below the Moon, except the Earth. Because the transmission of motion occurs because the spheres have contact with each other, each planet accumulates a growing daily delay in relation to its distance from the

[134] Tassoni, *Pensieri*, II, 4, p. 418.
[135] For the specific reference on motion used by Tassoni, see Antonio Bernardi's *De eversione singularis certaminis*, XXI, Section 7 in: Antonio Bernardi, *Disputationes. In quibus primum ex professo monomachia (quam singulare certamen Latini, recentiores duellum vocant) philosophicis rationibus astruitur [...] Accessit locuples rerum & verborum toto opere memorabilium, index* (Basel: Henricus Petrus, et Nicolaus Bryling, 1562), especially p. 384.

mover.[136] As Tassoni reports, if the power (*virtus*) of the mover is exerted with more force towards the bodies according to their proximity to the mover, it follows that the more distant planets will move slowly and their course will take more than one day, with the result they will fall proportionally behind in comparison with those closer to the mover.[137]As far as Alpetragius and the Telesians were concerned, this was the reason the planets and the eight spheres gave the appearance of moving in different directions. Tassoni shares with Alpetragius the idea of the natural westward motion of the planets and also the idea that the planets move at a slower speed compared with the stars, but as we have already seen, he rejected the existence of the celestial spheres. Therefore, Tassoni's argument for justifying the motion of the planets must be different. In fact, Tassoni explains planetary motion by employing a concept familiar since the Middle Ages, that of resistance. He argues that what seems to be the contrary motion of the planets with respect to the fixed stars is a consequence of their reduced speed because they are ploughing through a major quantity of celestial matter. Thus, meeting with major resistance, the planets fall proportionally behind, ending their course later in time. Tassoni's idea can be described as follows:

> I would therefore say that, since the stars are not attached to any sphere (if we do not call a sphere the path assigned and prescribed to their journey), they all move, according to ancient opinion, from east to west; but that the planets, being separated from the other stars, were delayed by the body that they split in passing so that they could not finish their course with the same rapidity and agility that the stars of the firmament do, and that therefore, as the stars constantly lose time from day to day, according to the opinion of Alpetragio, their [resulting] remaining behind seems to our eyes a contrary motion.[138]

[136] Lerner, *Il mondo delle sfere*, pp. 146–51.
[137] Tassoni, *Pensieri*, II, 4, pp. 418–19.
[138] 'Direi dunque che, non essendo le stelle affisse ad alcuna sfera (se non chiamiamo sfera la strada ch'è assegnata e prescritta al loro cammino), tutte si muovessero, secondo l'opinione antica, d'oriente in occidente; ma che i pianeti, essendo separati dalle altre stelle, fossero ritardati dal corpo ch'essi fendono passando sì che non potessero finire il loro corso coll'istessa prestezza ed agilità che fanno le stelle dette del firmamento e che perciò, andando eglino perdendo campo di giorno in giorno, secondo il parer d'Alpetragio, quel restare addietro paresse agli occhi nostri contrario moto', in Tassoni, *Pensieri*, II, 4, pp. 418–19.

The stars, conversely, move faster than the planets; because they are a multitude in the sky, when they move they meet with less resistance, and even then they can more easily deal with it:

> the so-called stars of the firmament move more easily because they do not have so much matter to pass through, most of them occupying themselves a large part of the area they pass, and for the same reason they also produce greater force in the place where they are found, as we see at the crossing of a torrent or a river that a hundred horses together cross much more easily than they cross one by one.[139]

By means of the concept of resistance, Tassoni also strengthens the reason for the slow speed of the Sun when compared with the motion of Mercury and Venus. He believes the speed of the Sun's movement is determined by its size: the bigger a body, the greater its resistance to the air it ploughs through during its motion. Therefore, the Sun, having a large volume, is slowed down more; each body that moves in a medium that offers resistance will be slowed down, but the speed of slowing will be determined by its size. This is the sense of the following words found in *quesito* 2 of Book 2 of the *Pensieri diversi*:

> But to the reasons of Telesio I add the mass of the solar body, which because of its size is more delayed by the body of the air that it moves through, as will be said, in the way that the bigger birds are, the more slowly they fly, even if they have more strength than small birds; this is because they find greater resistance in the air that they have to move through. And the same thing happens to ships in the water.[140]

In general, the resistance of the celestial bodies to the medium in which they move explains both the aspects and motion of the planets 'southernmost or northernmost, wider or smaller'.[141] Therefore, the differences between the planets are not due to their distance from

[139] 'le stelle dette del firmamento più agevolmente scorrono avanti perché non hanno tanta materia da fendere, occupando esse per la moltitudine loro una gran parte del campo che passano, e per l'istesso rispetto fanno anche maggior impeto in quella che trovano, come vediamo al passar d'un torrente o d'un fiume che molto più agevolmente il passano cento cavalli uniti che non farebbono passando ad uno ad uno', in Tassoni, *Pensieri*, II, 4, p. 419.

[140] 'Ma alle ragioni del Telesio io aggiungo la mole del corpo solare, il quale per la grandezza sua è maggiormente ritardato dal corpo dell'aria ch'ei fende, come si dirà, nella guisa che gli uccelli quanto sono maggiori, tanto volano più lentamente, ben che abbiano più forza de' piccioli, perchè nell'aria che fendono truovano incontro e resistenza maggiore. E l'istesso pure interviene alle navi nell'acqua', in Tassoni, *Pensieri*, II, 2, p. 412.

[141] 'or più astrali, or più boreali, or maggiori e or minori', in Ibid.

the prime mover. Consequently, Tassoni's thinking can also be contrasted with that of Aristotle, who explained the different speed of the planets by considering to what extent they were influenced by the most perfect nature of the prime immovable mover.[142] Tassoni puts forward two points according to which he invalidates Aristotle's thinking. First, because Aristotle considers the prime mover to be immovable, this would imply that rest means perfection and, therefore, the Earth should be considered to be the most perfect body because it is motionless. Second, because the Earth is the body furthest away from the prime mover, it should be conceived by Aristotle as not only being in motion but having different types of motion, and those even faster than the motion of the heavens; however, within the Aristotelian framework this is an absurdity.[143] Having drawn an overall picture of the theme of planetary motion, Tassoni's theoretical nucleus is as follows:

> in all celestial bodies there is the same principle of motion, namely, heat, and that which moves one star moves them all both always uniformly and by the same path, except that the seven inferior stars called wandering stars, or if there is another of the same nature, which have a broad path and are neither limited nor circumscribed, so that sometimes for some reason unknown to us rising, lowering themselves a little or bending a little more than usual to the right or left (as if to better partake of the influences of the areas of the world) they cannot in part vary their appearance or place without introducing eccentricities and epicycles which confuse the heavens and make one believe that divine things need machines and stops and wheels and props, as clocks do. In fact, if it were nothing but the observation made by some moderns of the star of Mars, which sometimes dips so low as to fall under the Sun, this should suffice.[144]

Overall, according to Tassoni, each type of movement is the result of a principle that is internal to each body in motion; more specifically, the internal underlying principle of the

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[142] Cf. Aristotle, *On the Heavens*, II, 12, in particular pp. 203–07.
[143] Tassoni, *Pensieri*, II, 2, p. 418.
[144] 'in tutti i corpi celesti è uno stesso principio di movimento, cioè il calore, e che quello che muove una stella le muove tutte e sempre uniforme e per la medesima strada, se non in quanto le sette inferiori chiamate erranti, o se altra ve n'è della istessa natura, avendo strada spaziosa, non sono ristrette né circoscritte di sorte che alle volte per qualche cagione a noi ignota alzandosi, abbassandosi alquanto o piegandosi un cotal poco più del solito a destra o a sinistra (come per meglio compartire gli influssi alle province del mondo), non possano in parte variare aspetto o sito senza introdurre eccentrici ed epicicli che confondono i cieli e dieno a credere che le cose divine abbiano bisogno di macchine e di soste e di ruote e di puntelli, come hanno gli orologi. Chè se non fosse altro che l'osservazione fatta da alcuni moderni della stella di Marte, che a volte s'abbassa tanto che viene a cadere sotto il sole, ciò ne dovrebbe bastare', in Tassoni, *Pensieri*, II, 4, pp. 419–20.

motion of bodies, the heavens included, is heat. Different kinds of motion exist in nature: the rectilinear motion of inferior things and the circular motion of celestial bodies. Furthermore, the celestial bodies all move from east to west and the difference in planetary motion is not due to the existence of solid spheres around which the planets rotate, but to the resistance of the matter through which they plough when they move.

These theories pave the way for the theme at the core of Chapter 4: the cosmos. The principles of heat and cold play a role in the arrangement of the cosmos, and the topics analysed will be the material and structural composition of the elements, the extension of the cosmos, and the natural phenomena that fed cosmological debates at the dawn of the Scientific Revolution.

CHAPTER 4: ON THE COSMOS

This chapter examines Tassoni's ideas about the cosmos. Consistent with the fundamental principles underlying Tassoni's entire natural philosophy, as outlined in Chapter 3, the principles of heat and cold determine the arrangement of the constitutive elements of the whole universe. The ordering and functioning of these elements are almost perfectly intelligible to human beings precisely because these processes are based on natural principles. Here, we will see that Tassoni's reflections on the cosmos result in the acceptance of a world system centred on the Earth, in line with the traditional view supported since antiquity and strongly promoted by religious authorities.

The debates about the cosmological worldview were, in fact, complex. Many factors, from philosophical reasoning and common-sense explanations to theological evidence and political influences, were involved in shaping opinion about the world system, and this was a time when new proposals that contrasted with the traditional view of the geocentric and geostatic universe were appearing.[1] The most noteworthy example is, of course, heliocentrism, which presented the biggest challenge to the traditional model of the world system. Since the publication of Copernicus's *De revolutionibus* in 1543, the necessity of restricting the Sun-centred cosmos to a mere mathematical hypothesis was widely promoted first by university professors of astronomy and then by religious authorities.[2] The historical implications of the

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[1] E. Grant, *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts* (Cambridge: Cambridge University Press, 1996).
[2] For more insight on the concept of 'hypothesis'and its significance within the background of early modern science, see Guido Morpurgo Tagliabue, *I processi di Galileo e l'epistemologia* (Milan: Edizioni di comunità, 1963).

acceptance of heliocentrism have been often discussed, especially Galileo's beliefs and his resulting trial, as will be discussed in Chapter 5.[3]

It is not surprising in light of the above that Tassoni's *quesiti* concerning the world system were aimed at supporting a quite traditional position. However, here, it will also be pointed out how the recent discoveries contributed to the destruction of a long-lasting view of the structure of the world. In this sense, I will show how Tassoni gradually departs from Aristotelian ontology and replaces it with theories that although built on the same foundations, are presented by their supporter as keystones for a more tenable interpretation of the reality.

With this aim in mind, the themes analysed here regard the cosmos as a structure divided into two regions (the celestial region and the terrestrial region) and that is comprised of the four elements (earth, water, air, fire). In addition, comets will be used to stress the significance of those phenomena for which the interpretation did not fit the consolidated cosmological order and so to show how medieval geocentric cosmology started to be undermined. The analysis ends with some considerations as to the possibility of an infinite extension of the cosmos, showing how openness towards new proposals had implications for the understanding of the world.

The *quesiti* employed for the reconstruction of Tassoni's theory about the cosmos are entitled: I. 1: *Che ci sia l'elemento del fuoco (*Whether elemental fire exists);[4] II, 3: *Se il cielo che noi vediamo sia in varie sfere distinto o sia una continua e uniforme materia per entro la quale si muovano i pianeti e le stelle* (Whether the heavens are divided into spheres or are made

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[3] For an account on the controversies that led Galileo to defend the heliocentrism, see Ludovico Geymonat, *Galileo Galilei: A biography and Inquiry into His Philosophy of Science*, trans. by Stillman Drake (New York: McGraw Hill, 1965), and William Shea, *Galileo's Intellectual Revolution* (London: MacMillan, 1972). For the consequences of Galileo's heliocentric ideas, see Owen Gingerich, 'The Galileo Affair', *Scientific American* 247, no. 2 (1982), 132−43; Maurice Finocchiaro, *On Trial for Reason: Science, Religion and Culture in the Galileo Affair* (Oxford: Oxford University Press, 2019), pp. 155−70. For a more general overview of the most relevant documents related to Galileo's trial, see M. Finocchiaro, *The Galileo Affair: A Documentary History* (New York: The Notable Trials Library, 1991). More bibliography on the topic is provided in Chapter 5.
[4] Tassoni, *Pensieri*, I, 1, pp. 373−83.

up of one continuous and uniform matter in which planets and stars move);[5] II, 6: *Se la materia dei corpi celesti sia una sola e senza mistura* (Whether celestial matter is comprised of a single substance);[6] II. 7: *Che cosa sieno le comete e come saliscano all'ottava sfera* (What are comets, and how do they reach the eighth sphere);[7] IV, 12: *Per che cagione la terra e l'acqua stieno unite al centro del mondo* (Why the Earth and water are located at the centre of the universe);[8] IV, 13: *Se l'acqua sia più alta della terra* (Whether water is above the Earth);[9] IV, 14: *Se il centro del mondo sia nell'acqua o nella terra* (Whether the centre of the universe is in water or the Earth)[10].

In developing Tassoni's conception of the cosmos I will take into account the positions of different natural philosophers, for example, Girolamo Cardano, Bernardino Telesio, Francesco Patrizi, and Giordano Bruno. These will help in understanding the context within which Tassoni's discourses took place.

4.1 The heavens

Matter and form

Tassoni's cosmos is structured following the traditional division between the heavens and the terrestrial realm. Aristotle and the Aristotelian tradition attest that both of these consist of matter and form. This assumption is supported by Tassoni and it can be taken as the starting point of his discussion about the celestial region, the topic this section is devoted to.

During the Middle Ages, the predominant positions concerning the celestial region embraced the existence of both celestial matter and form, but the subsequent issue of the nature

[5] Tassoni, *Pensieri*, II, 3, pp. 412−16.
[6] Tassoni, *Pensieri*, II, 6, pp. 422−24.
[7] Tassoni, *Pensieri*, II, 7, pp. 424−25.
[8] Tassoni, *Pensieri*, IV, 12, pp. 499−500.
[9] Tassoni, *Pensieri*, IV, 13, pp. 501−02.
[10] Tassoni, *Pensieri*, IV, 14, pp. 503−05.

and composition of the matter was still subject to discussion at the end of the seventeenth century.[11] Tassoni's theories emerge from the same theoretical struggles faced by his predecessors in their attempts to clarify the essence of the heavens. Therefore, the main points of the debates, to which Tassoni introduces innovative elements (as will emerge once his scientific thinking is entirely reconstructed), can be presented by means of Tassoni's reflections on the topic.

First of all, Tassoni claims it is impossible to envisage the celestial bodies as devoid of form. They are the most perfect bodies in the universe, and maintaining that their structure had no form would mean, in fact, that they would have to be considered as imperfect:

> if form means perfection, as Aristotle states at the beginning of the second book of *Generation of Animals* and as can be observed in these earthly things which are impossible or imperfect devoid of form, then how can we even think that the celestial bodies, which are most perfect by nature, can only be made by matter devoid of form?[12]

This statement is a reference to Book 2 of Aristotle's *Generation of Animals*, in which he speaks about the creation of individuals and refers to the male and the female as two different principles of creation that can be considered to be the form and the matter, respectively, a scenario in which the form is 'better and more divine than the matter':

> it will surely be for the sake of creation that "the male" and "the female" are present in the individuals who are male and female. And as the proximate motive cause, to which the *logos* and the Form belong, is better and more divine in its nature than the Matter, it is better also that the superior one should be separated from the inferior one. This is why wherever possible and so far as possible the male is separated from the female, because it [the male] is something better and more

[11] For an overview of this topic, see Grant, *Planets, Stars, and Orbs*, pp. 244–70.
[12] 'se la forma è perfezione, come vuole Aristotle nel principio del 2. della *Generazione degli animali* e come il vediamo in queste cose terrene, che senza forma sono impossibili nonchè imperfette, con che ragione vogliam noi darci a credere che i corpi celesti, perfettissmi di natura loro, abbian da esser fatti di sola materia e sformati?', in Tassoni, *Pensieri*, II, 6, p. 422.

> divine in that it is the principle of movement for created things, whereas the female serves as their matter.[13]

Therefore, because the perfection of the corporeal substance lies precisely in its form, as is evident in respect of the terrestrial creatures, Tassoni concludes that it would be impossible for the heavens not to have this quality.[14]

However, the terrestrial region is the place of corruptibility: terrestrial things, which are comprised of matter and form, are all corruptible, whereas the traditional worldview considers the celestial region as incorruptible.[15] This raised questions about the possibility that bodies' corruptibility was because they had both matter and form. Tassoni does not reject the traditional worldview but only the question raised, by demonstrating that corruptibility is not caused by the presence of matter and form in a body; rather, it is the result of bodies having different material compositions.

The terrestrial bodies are comprised of conflicting elements, and their matter has the potential to be converted into any sensible form. Conversely, as all Peripatetics theorised, the form of celestial matter expresses entirely all the possibilities of that matter; to put it another way, other forms are not possible for celestial matter, only the one it possesses, which, therefore, is perfectly actualised. In other words, because celestial matter lacks the potential to appear in any other form, it cannot be corruptible:

> Concerning the corruptibility claimed by some people [Aristotelians], it is true that these earthly things are corruptible but not because they are made both of matter and form, rather because their innate matter is always linked to the potential for all other forms and recognizes the absence [of these forms] by the third principle, to speak thus, and because they are made of opposite qualities. But celestial matter

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[13] Aristotle, *Generation of Animals*, trans. by A. L. Peck, LCL 366 (Cambridge, MA: Harvard University Press, 1942), II, 1, pp. 131–33.

[14] For Aristotle's idea of creation, see Enrico Berti, 'La generazione dell'uomo secondo Aristotele', in *Nuovi studi aristotelici*, vol 2: *Fisica, antropologia, metafisica* (Brescia: Morcelliana, 2005), pp. 150–57. For more insights, see also E. Berti, Quando esiste l'uomo in potenza? La tesi di Aristotele, pp. 143–50 and E. Berti, 'Genesi e sviluppo della dottrina della potenza e dell'atto in Aristotele', *Studia Patavina*, 5 (1958), 477–505.

[15] See Grant, *Planets, Stars, and Orbs*, pp. 189–219.

> does not have either potentiality or absence [of forms], being incapable of any other form [than the one it possesses].[16]

Having defended the traditional position in favour of the heavens possessing both matter and form, Tassoni then addresses the topic of the nature of celestial matter. Here, his departure from Aristotle is strengthened.

Celestial matter

In Chapter 3, some of Tassoni's ideas attesting that his conception of celestial matter was different from the Aristotelian tradition have already emerged. Indeed, Tassoni believed that the heavens consisted of a transparent matter similar to air, but even purer and more limpid. The characteristics of this matter did not correspond to those assigned to the ether by Aristotle. However, most sixteenth-century authors accepted the structure and matter of the heavens as taught by Aristotle.[17]

The concept of the ether was connected with the notion of a matter divided into spheres in which the planets were embedded. This matter was considered to be impenetrable and completely different from any other element. In point of fact, however, the Aristotelian tradition did not put forward any clear theory about the physical nature of the celestial spheres, and Aristotle's commentators and the medieval natural philosophers did not have a coherent answer as to whether they were solid or fluid.[18]

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[16] 'E quanto alla corruttibilità che oppongono alcuni, è vero che queste cose terrene sono corruttibili, ma non perch'elle siano composte di materia e di forma, ma perchè la prima materia loro ha sempre congiunta la potenza a tutte l'altre forme e riconosce la privazione per terzo principio, per così dire, e perché di qualità contrarie son misturate. Ma la materia celeste non conosce né potenza né privazione, essendo incapace di ogni altra forma', in Tassoni, *Pensieri*, II, 6, p. 422.

[17] For the evolution of celestial matter theory, see Grant, 'Celestial Matter: A Medieval and Galilean Cosmological Problem', *Journal of Medieval and Renaissance Studies*, 13 (1983), pp. 157−86: M. P. Lerner 'Le problème de la matière céleste après 1550', *Revue d'histoire des sciences* 42 (1989), pp. 255−280. Also, for the acceptance of the existence of spheres in the heavens during the early seventeenth century, see W. H. Donahue, *The Dissolution of the Celestial Spheres 1595–1650* (New York: Arno Press, 1981); Miguel Ángel Granada, *Sfere solide e cielo fluido. Momenti del dibattito cosmologico nella seconda metà del Cinquecento* (Milan: Guerini e associati, 2002). See also the bibliography included in the previous chapter of this thesis: Chapter 3, Section 3.4.

[18] See Grant, *Planets, Stars, and Orbs*, pp. 324–70.

Nevertheless, at the turn of the sixteenth century, a debate about the characteristics of celestial matter led to a distinction between solid spheres, that is, those that were hard and impenetrable, and fluid-like spheres, which, conversely, were linked with the idea of soft and penetrable matter. Tycho Brahe's observations and work, as will soon be shown, were of fundamental importance for the achievement of a new understanding of the material composition of the heavens.

Although Tassoni denied the existence of celestial spheres, he did not ignore the debate about the characteristics of celestial matter. With the aim of highlighting deficiencies in the reasoning of those who supported the existence of the spheres, Tassoni retraces the arguments that, for centuries, had been considered to support the Aristotelian view of the celestial spheres.[19] This topic is discussed in *quesito* 3 of Book 2 of the *Pensieri diversi*, *Se il cielo che noi vediamo sia in varie sfere distinto o sia una continua e uniforme materia per entro la quale si muovano i pianeti e le stelle* (Whether the heavens are divided into spheres or are made up of one continuous and uniform matter in which planets and stars move).

From ancient theories to the most current and updated scientific discoveries, there is no dearth of sources that can be employed to analyse this question; however, Tassoni's *quesito* appears to have few, if any explicit references to these sources. Nevertheless, the arguments discussed by Tassoni represent the widespread opinions on the topic.[20] These are, for example, the theories of both pre-Aristotelian philosophers and coeval thinkers, referred to in doxographical works and medieval comments, or made available by means of the critical

[19] For a detailed account of this topic, see Michel-Pierre Lerner, *Il mondo delle sfere*.
[20] A useful instrument of knowledge is the *Almagestum novum* written by Giovanni Battista Riccioli (1598–1671). Although this was only published in 1651 and, therefore, cannot be a source for Tassoni's knowledge, for us, it is still a reliable means by which to comprehend interpretations of the topic under consideration and a source from which to make inferences about the figures behind Tassoni's theoretical references. See Giovanni Battista Riccioli, *Almagestum novum astronomiam veterem novamque complecten. Observationibus aliorum, et propriis novisque theorematibus, problematibus, ac tabulis promotam. In tres tomos distributam quorum argumentum sequens pagina explicabit avctore Ioanne Baptista Ricciolo* (Bologna: Haeredis Victorij Benatij, 1651).

assessment of previous philosophies by Renaissance thinkers such as Giovanni Francesco Pico della Mirandola (1469–1533).[21]

In Chapter 3, Section 3.4 of this thesis, it has been seen that the existence of real spheres in the heavens was an argument employed by many to give a reason for the variation in planetary motion. This seems to be a strong and apparently efficient claim, referred to by Tassoni himself:

> There is no other way to explain the variety of the motions of the planets that move westward with the eighth sphere and eastward with another motion of their own. In fact, if celestial matter were indistinct and continuous, it would be possible to see a uniform motion of all seven planets and the eighth sphere.[22]

The theory of the reality of the celestial spheres invalidates the position of those who consider the planets as bodies attached to one single sphere, that is, 'lamps in the churches' or 'heads of gold stuck in a crystal', in an air-like heaven or a crystalline mass. [23] In fact, within this theoretical framework, the particular motions of the planets would not find an explanation:

> If planets are like lamps attached to the eighth sphere, how do they move back [eastward] while the eighth sphere moves westward and how do they change appearances and places? Certainly, in this scheme, it would be necessary for them to have a rope and a guard that pushed and pulled them here and there.[24]

Not even the belief of the existence of oblique channels, within which the planets would be moved by different intelligences, can be persuasive enough to deny the existence of celestial spheres. In fact, when considering whether the channels were void or filled by some matter or

[21] The critical work I refer to here is Giovanni Francesco Pico, *Examen vanitatis doctrinae gentium, et veritatis Christianae disciplinae, distinctum in libros sex, quorum tres omnem philosophorum sectam vniuersim, reliqui Aristoteleam et Aristoteleis armis particulatim impugnant, vbicunque autem Christiana et asseritur et celebratur disciplina* (Mirandola: Ioannes Maciochius Bundenius, 1520).

[22] 'Né per altra via pare che la diversità de' moti che ne' pianeti si vede possa salvarsi, girandosi eglino tutti coll'ottava sfera d'oriente in occidente e poi ciascuno di loro d'occidente in oriente d'un altro moto particolare. Ché se la materia de' cieli tutti fosse indistinta e continua, un solo moto uniforme di tutti e sette i pianeti e dell'ottava sfera si dovrebbe vedere', in Tassoni, *Pensieri*, II, 3, p. 412.

[23] 'lampade nelle chiese', 'chiodi d'oro ficcati in un cristallo', in Tassoni, *Pensieri*, II, 3, p. 413.

[24] 'se i pianeti si stanno come lampade attaccati all'ottava sfera, come ritornano essi all'indietro mentre ch'ella si gira verso occidente e come variano aspetti e luoghi? Certo di questa maniera egli si converrebbe che avessero una fune e un custode che gli andasse tirando ora qua or là', in Tassoni, *Pensieri*, II, 3, p. 414.

other, further theoretical difficulties arose. Tassoni observes, ‘would those channels within which the planets move be empty or filled [with any substance]? If empty, there would be the vacuum, contrary to so many explanations by Aristotle, and if filled, they would be filled with a subtler substance’.[25]

As Tassoni points out, Aristotelian arguments exclude both alternatives: the channels viewpoint because it implies acceptance of a vacuum or suggests that different bodies and matters exist in the heavens and, therefore, raises the issue of the presence of mixed matter; and the argument for the existence of one single sphere because it does not explain the different orientation of the planetary motion.

Consequently, Tassoni moves to the consideration of the existence of many spheres. In this regard, the crucial question of the nature of these or, in other words, what kind of matter they are comprised of, is addressed. Essentially, Tassoni considers both the fluid heavens hypothesis and the opposite one, which supports the theory of the hard/solid spheres. However, it should be borne in mind that Tassoni's focus on the celestial spheres around which the planets rotate is an expedient designed to strengthen his own sphere-less theory of the heavenly motions. By beginning with the apparent validity of the existence of a multiplicity of celestial spheres, Tassoni then critically analyses a number of theories in support of this by offering an overview of the insoluble problems they pose. Therefore, the untenability of the theories presented in support of the existence of celestial spheres stands out as evident and, therefore, a viewpoint widely accessible to his readers.

As Tassoni reports, the spheres could be considered to be made of a solid, hard matter or, conversely, of a light liquid substance.[26] Whereas the latter assumption can easily be

[25] ‘que’ canali per entro i quali hanno da correre i pianeti saranno eglino voti o ripieni? Se voti, si darà il vacuo, contra tante ragioni addotte da Aristotele; e se pieni, d'altro corpo più vano saranno ripieni’, in Tassoni, *Pensieri*, II, 3, p. 414.

[26] Tassoni, *Pensieri*, II, 3, p. 413.

undermined by pointing out that if the spheres were made of fluid matter, in fluid heavens, they could not remain separated (in fact, they would rather blend together), the first hypothesis, namely, the theory that considers the presence of solid spheres in the heavens, requires more examination.

The main problem linked to the assumption of solid spheres concerns the possibility that they flow. Indeed, on a continuous and hard surface, the capacity for solid bodies to flow appears to be possible only by introducing space between them; otherwise, they would rotate together in the same direction by a single motion. Consequently, a question arises: what separates these spheres? Tassoni considers the opinion according to which the solid spheres are separated from each other by the presence of an air-like matter. In this case, the spheres would be able to flow, but according to Tassoni, this idea leads to the untenable theory that supports the mixed composition of the celestial matter. In this case, the heavens would be comprised of the solid matter of the spheres and the light liquid matter in-between them. Furthermore, according to Tassoni, assuming the existence of solid spheres would even be in contrast to Aristotle's conception of the heavens. By referring to Aristotle's *On the Heavens*, Tassoni acknowledges that the ethereal substance embraced by the Aristotelians is not a mixed matter, but a single light celestial substance, and that the celestial bodies differ from the heavens simply in terms of density. In this case, of course, it must be assumed that the heavens and the spheres are very insubstantial so as to justify their invisibility compared with the luminosity of the stars, which is due to their greater density.

However, Tassoni had already rejected the hypothesis that considered the spheres to be comprised of a light substance. In this context, Tassoni recalls the metaphor of the *nodi in tabula*, considered representative of the Aristotelian relationship between the planets and their spheres, to further invalidate the idea of insubstantial spheres:

> But it is not plausible that [the celestial spheres] are subtle and imperceptible bodies and that the stars are fixed in them like knots in a wooden board. Moreover, since the westward motion of the planets is unnatural, as these are seized by the eighth sphere, if the eighth sphere seizes them by force, it would do so immediately or via another body that is not subtle (i.e., that is dense).[27]

Indeed, within the same Aristotelian theoretical framework, this assumption would not give a reason for the different planetary motions, which had been explained by considering that the eighth sphere dragged the planets from east to west, which is in the opposite direction of their natural motion and, thus, generated their different motions. This operation would be valid only for a system within which the spheres were considered to be solid.

In short, these considerations showed the untenability of those theories according to which the heavens were made of a fifth type of quintessential matter divided into different spheres in which the planets were embedded and rotated. In fact, if this matter were considered solid, it would be impossible to explain why the heavens did not have their own luminosity, whereas if it were deemed to be fluid, it would make it impossible to provide a solution as to why the eighth sphere could drag the stars in a westerly direction. Moreover, these arguments clarify why Tassoni does not support the reality of the spheres, favouring the theory of the free path of the celestial bodies in a sphere-less heaven, a notion that was already supported by Patrizi in opposition to Telesio.[28] As we will see in the following section, inevitably, Tassoni's conception of the celestial matter also entails the rejection of the immutability of the heavens, another pillar of Aristotelian theory.

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[27] 'Ma che sieno corpi vani in guisa che fuggano il senso e si stieno in essi fisse le stelle come i nodi in una tavola d'abete, non ha del verisimile. Oltre che, non essendo naturale il movimento de' pianeti da oriente in occidente, come quelli che dall'ottava sfera vi sono rapiti, se l'ottava sfera li rapisce a forza, convien che lo faccia toccandogli immediatamente o mediante qualche altro corpo che non sia vano', in Tassoni, *Pensieri*, II, 3, p. 414.
[28] Cf. Chapter 3, Section 3.4.

The (im)mutability of the heavens

Tassoni disagreed with the idea of the immutability of the heavens by pointing out that if this were true, we would not experience certain effects in our realm that have their origins in the celestial region, for example, the heat we receive from the Sun, and the influence of the planets. The focus on these effects contributes to defining Tassoni's idea of the celestial substance and adds some detail to its nature. Specifically, Tassoni questioned whether the celestial matter was comprised of a single substance only, and his analysis can be found in *quesito* 6 of Book 2 of the *Pensieri diversi*, *Se la materia dei corpi celesti sia una sola e senza mistura* (Whether celestial matter is comprised of a single substance).

The perceivable differences between the celestial bodies, that is, the different influences exerted by planets that were to all intents and purposes otherwise exactly the same, and their difference in luminosity, density, and speed, seemed to testify to a mixed and compound heavenly substance. In spite of this, Tassoni believed that all the celestial bodies were comprised of a single substance.[29] In fact, assuming the heterogeneity of the celestial matter would have been a means of considering them subject to corruption. As mentioned above, Tassoni considers the corruptibility of the bodies to be the consequence of a compound substance that is comprised of different elements and, as a result, generates different characteristics that are in conflict with each other, the process ultimately causing the corruption of the bodies. However, he excludes the possibility that the dissimilarities found in the celestial region are caused by a non-uniform matter. How, then, can the presence of the aforementioned differences and conflicting characteristics in a region that is considered uniform and incorruptible be justified? According to Aristotelian tradition, the heavens were considered to be made of ether, a substance devoid of any conflicting characteristics and, among other

[29] For the difference between the celestial bodies reported by Tassoni, see *Pensieri*, II, 6, p. 423.

arguments, the absence of opposites in the heavens was inferred from the simplicity of the circular motion that defined them.[30] However, Tassoni rejects the link between circular motion and the simplicity of the celestial bodies:

> Some well-respected men thought that Aristotle demonstrated the simplicity of the celestial bodies via the simplicity of their motion. But I do not understand how in the heavens where they themselves identify so many different and contrary motions: eastward, westwards, southwards, northwards, to the summit, to the bottom of the epicycles, unregulated, of trepidation and of so many other ways, they can say that one simple motion is found there. Because if they call it a simple motion since all those bodies move in a circular way [...], the same reason can be used to prove that all those four bodies [elements] are moved with a single simple motion since they all move with a straight motion.[31]

We can hear in Tassoni's words the Telesian argument rejecting the idea that the rectilinear and circular motions reflect the difference in terms of substance between the elemental bodies and the heavens, respectively, as we have seen in Chapter 3.[32] Moreover, according to Tassoni, the same reference to the circular motion of the heavens would attest to the presence of opposites therein, because the direction of and variation in the planetary motions, according to the Aristotelian system of reference, argues in support of the celestial bodies possessing conflicting characteristics. Interestingly, the discussion about the immutability of the heavens, which was linked to the topic of the presence of conflicting elements therein, had also been addressed by Patrizi in a way that seems to support further the intellectual closeness between Tassoni and Patrizi. In contrast to the Aristotelian tradition, indeed, in his *Discussiones peripateticae* (1581), Patrizi uses many arguments, which are also

[30] Cf. Aristotele, *On the Heavens*, I, 2, p. 13.
[31] 'Alcuni uomini grandi vollero che Aristotele provasse le simplicità de' corpi celesti in vigore della simplicità del moto. Ma io non so come in cielo, dove essi introducono tanti moti diversi ed opposti: all'oriente, all'occidente, all'austro, all'acquilone, al sommo, al fondo degli epicicli, sregolati, di trepidazione e d'altre tante maniere, possano dire che uno e semplice moto vi si ritrovi. Ché se semplice moto lo chiamano perché tutti que' corpi circolarmente si muovano […] colla stessa ragione potrà provarsi che tutti que' quattri corpi si muovano d'un solo e semplice moto poi che si muovono tutti di moto retto', in Tassoni, *Pensieri*, II, 6, p. 422.
[32] Chapter 3, Section 3.3.

mentioned by Tassoni, to reject the idea of the heavens being devoid of opposites, including the evident differences between the celestial bodies in terms of colour, density, and motion:

> What did Aristotle see in the heavens? […] What other qualities if not certain lights and certain obscurities? […] If these were [in the heavens] and he [Aristotle] saw them, why did he not admit that there are at least two opposite qualities in the heavens? Lightness and darkness? Transparency and opacity? Lightness as a quality of all stars, and darkness on the face of the moon? Transparency in the spheres, opacity in the moon, in the other planets?[33]

If in the excerpt reported above, Patrizi focuses on the difference between bright (and therefore visible) celestial bodies and dark (or invisible) bodies, shortly afterwards, a reference to the variation in planetary motion is found: 'as far as the motion is concerned there are also opposites [in the heavens], opposite directions, westward motion, eastward motion, planets's antecession, retrogression, and stoppings as well as slowness and velocity, motion towards apogee and perigee'.[34]

Patrizi's criticism led him to reject even the eternity of the universe, as attested in his *Nova de universis philosophia* (1591).[35] Conversely, despite his own attack on Aristotelian tradition, Tassoni defends the eternity of the celestial region. He aims to explain the dissimilarities found therein by excluding the possibility that these are caused by a non-uniform type of matter. Accordingly, Tassoni justifies the variation in colour and luminosity, and the

[33] 'Visus igitur quid ibi videt? […] Quas inquam alias qualitates, quam lumina, quam obscuritates quasdam […] Si fuerunt et vidit, cur non fatetur, ibi esse has duas saltem contrarietates? Luminosi et obscuri, diaphani et opaci? Luminosum in stellis omnibus obscurum in lunae facie? Diaphanum in orbibus, opacum in luna, in alijs planetis?', Patrizi, *Discussiones*, t. 4, VI, p. 429, in Francesco Patrizi, *Discussionum Peripateticarum tomi 4* (Basle: ad Perneam Lecythum, 1581).
[34] 'et extra praedicamenta motus quoque ibi contrarii sunt, à contrari terminis, ab oriente in occidens, ab occidente in oriens, contrarietas quoque antecessionis planetarum, retrocessionis, stationis, tarditas itidem ac velocitas, in apogeum scadere, in perigeum descendere', Ibid.
[35] Cf. Cesare Vasoli, 'Francesco Patrizi da Cherso e la critica del concetto aristotelico dell'eternità del mondo, del tempo e del moto' in '*Sapientiam amemus*'. *Humanismus und Aristotelismus in der Renaissance*, *Festschrift für Eckhard Kessler zum 60 Geburtstag*, ed. by P. R. Blum, C. Blackwell, and C. Lohr (Munich: Fink, 1999), pp. 141–79; C. Vasoli, 'Sophismata putida. La critica alla dottrina peripatetica dell'eternità e immutabilità del cielo', in *Francesco Patrizi. Filosofo platonico nel crepuscolo del Rinascimento*, ed. by Patrizia Castelli (Florence: Olschki, 2002), pp. 167–80. For more details on Patrizi's criticism of Aristotelianism, see Maria Muccillo, *Platonismo, ermetismo e prisca theologia. Ricerche di storiografia filosofica rinascimentale* (Florence: Olschki, 1996), pp. 73–193.

different effects of the different bodies in terms of a single substance that shows different degrees of perfection in each body formed of it:

> I would say that celestial bodies are comprised of simple matter and simple form; their matter is only one and is different, that is, only one in all of them and different in each one of them. The matter of the sun is different from the matter of the moon, that is, different in perfection; the matter of the moon is different from that of the stars, and the matter of the stars is different from that of the ether. From these differences is born the diversity of colours, light, and effects.[36]

After having recalled and opposed the more common theories on celestial matter, Tassoni's own idea, which is in favour of the fluid heavens hypothesis, can be delineated by saying that the so-called ether was nothing but a simple, uniform, but penetrable substance comparable with a diaphanous and pure air, or a substance similar to air, in Tassoni's words:

> Moved therefore by these difficulties, I resolve to believe that from the circle of the moon to the heavens, called the primum mobile, there is nothing other than a transparent matter similar to air, indeed more limpid and pure; but not […] completely unchanging, as we can see from the comets and stars that appear in it and from the heat of the sun that it receives and transmits.[37]

We will see that in his theory on celestial substance, Tassoni leans towards the theoretical position widely accepted by thinkers, especially the Jesuits, in the years immediately following the discovery of new bodies in the heavens. Indeed, this conception of celestial matter also played a role in the rejection of both Aristotelian notions of celestial spheres and the theory of the immutability of the heavens even for those strongly supporting the traditional view. For example, Clavius, despite being a Jesuit and therefore a promoter of the Aristotelian system,

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[36] 'io direi che i corpi celesti non abbiano altra mistione che quella che dà loro una semplice materia e una semplice forma, la qual materia sia una sola e diversa cioè una sola in tutti e diversa in ciascheduno di loro. La materia del sole è diversa da quella della luna, cioè diversa di perfezione; quella della luna è diversa da quella delle stelle e quella delle stelle è diversa da quella dell'etere. E però quindi nasce la diversità de' colori, del lume e degli effetti', in Tassoni, *Pensieri*, II, 6, p. 424.

[37] 'Mosso dunque da tali difficoltà, io mi risolvo a credere che dal cerchio della luna fino al cielo chiamato del primo mobile non vi sia altro che una materia trasparente simile all'aria, anzi più limpida e pura; ma non […] impassibile affatto, come dalle comete e dalle stelle che appaiono in essa e dal calor del sole ch'ella riceve e trasmette si può vedere', in Tassoni, *Pensieri*, II, 3, pp. 415–16.

reacted to the new astronomical findings by introducing amendments to the old doctrine that claimed the immutability of the heavens.[38] In fact, as will be seen when addressing Clavius's interpretation of the supernova of 1572, his thinking with regard to the conception of the heavens was subject to revision. The celestial novelties, which caught the attention of philosophers, astronomers, astrologers, and learned men all over Europe, gave birth to lively debates that are the focus of Section 4.2.

4.2 Between the heavens and the Earth: Debates about comets

Interpretative problem of new astronomical events

In the late sixteenth century, the occurrence of unexpected astronomical events, which attested that the heavens were subject to changes, confirmed anti-Aristotelian positions with regard to the cosmos. The appearance of a nova in Cassiopeia in 1572, visible until 1574, falls under the category of such events.[39] It was located in a place in the sky where previously no star had existed.

The Danish astronomer Tycho Brahe (1546–1601) was one of the first to interpret the phenomenon as a new star.[40] By using triangulation, he reported the absence of parallax, confirming that the star was apparently situated above the Moon's sphere. This consideration paved the way for new investigations into the constitution of the heavens that were able to ride

[38] For information about Clavius and the Jesuits, see Ugo Baldini, *Legem impone subactis: studi su filosofia e scienza dei Gesuiti in Italia: 1540–1632* (Rome: Bulzoni, 1992). More details can be found in Chapter 5, Section 5.1 of this thesis: Between science and religion: The Jesuit order.

[39] G. Coradeschi, 'Contro Aristotele e gli aristotelici: Tycho Brahe e la nova del 1572 in Italia', in *Galilæana: Journal of Galilean Studies*, vol. 6, ed. by Istituto e Museo di Storia della Scienza (Florence: Olschki, 2009), pp. 89–122; C. Doris Hellman, 'The New Star of 1572: Its Place in the History of Astronomy', in *Actes du IXe Congrés International d'Histoire des Sciences* (Barcelona: Universidad de Barcelona-Hermann, 1959), pp. 482–87.

[40] T. Brahe, *Tychonis Brahe, Dani de nova et nullius aevi memoria prius visa stella, iam pridem Anno à nato Christo 1572, mense Novembrj primùm conspecta, contemplatio mathematica* (Copenhagen: Laurentius Benedictj, 1573).

the wave of the recent criticism of Aristotle's physics.[41] More precisely, the historical relevance of Brahe's statement lies in the consideration of supposed changes in the heavens. If such changes did occur, one of the most substantial arguments in support of the essential difference between the celestial region and the terrestrial region, namely, the immutability of the heavens as opposed to the changeability of the terrestrial region, would necessarily disappear.

The nature of the nova was, however, a matter of debate, which demonstrated the radical differences in the interpretation of the phenomenon, as well as the difficulty of providing a compelling and broadly shared understanding of the celestial event. It is worth repeating that Brahe himself was convinced there was a substantial difference between celestial and terrestrial matter.[42] Moreover, there were still many who supported the view that the body was located below the Moon's orbit; that is, they offered alternative understandings of the phenomenon compatible with the theoretical assumptions of Aristotelian philosophy. Therefore, the interpretations of celestial appearances were various, and often contradictory.[43] To put it simply, since changes in the celestial region were denied by Aristotelian thought, everything that seemed to support a mutation in the heavens was considered to be the result of something that happened in the terrestrial region. In this sense, it is clear why *novae* were often confused with comets, that is meteorological phenomena.[44] Tassoni himself refers to the nova of 1572 as if it were a comet. Moreover, when trying to explain the theory of comets held by Tassoni,

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[41] It should be pointed out that if modern scholarship on the rejection of the reality of the spheres is considered in relation to both Brahe's and Patrizi's thinking, agreement is not always reached as to who should be given credit for the origins of the idea and the possible reciprocal influences. On this topic, see, for example, E. Rosen, 'Francesco Patrizi and the Celestial Spheres', *Physis*, 26 (1984), 305–24 and P. Rossi, *Il tempo dei maghi. Rinascimento e modernità*, ed. by P. Rossi (Milan: R. Cortina, 2006), pp. 185–225.

[42] Cf. C. Doris Hellman, 'Was Tycho Brahe as Influential as He Thought?', *British Journal for the History of Science*, 1 (1963), 290–300.

[43] For an accurate analysis of both the positions of and the relationships between the thinkers who have been briefly examined here, and a detailed bibliography on the topic, see Dario Tessicini, 'Il dibattito italiano sulla nuova stella del 1572 (con il testo del "Discorso intorno a la stella" di Giuseppe Valdagno, ms Ambrosiana R 95 sup.)'. In *Novas y cometas entre 1572 y 1618. Revolución cosmológica y renovación política y religiosa*, ed. By Miguel Ángel Granada (Barcelona: Universitat de Barcelona, 2012), pp. 43–94.

[44] Lerner, *Tre saggi sulla cosmologia alla fine del Cinquecento*, pp. 73–104.

it should be noted that in his *Pensieri diversi* he does not provide a clear explanation as to the nature of the phenomenon.

The conflicting opinions that were expressed at the time shed some light on the ideas, sources, and opinions within the Italian intellectual debate that still need investigation, and within which Tassoni's reflections should be included. With this in mind, the following analysis represents the *status quaestionis* on the topic, especially in the Italian context.

Meteorological theories

The Italian intellectual output on the phenomenon of 1572 confirms the difficulty of defining the essence of the body observed. The attempt to provide an understanding compatible with the Aristotelian doctrine of the immutability of the heavens gave birth to those theories that rejected the possibility of identifying the body visible in Cassiopeia as the first of a new generation of bodies of celestial origin. Those who agreed with this understanding explained the phenomenon in terms of changes that had occurred in the sublunar region. Despite a few and significant variants, an interpretative line compatible with Aristotelian principles was attempted by those figures who became pivotal voices in the Italian debate about the celestial event of 1572, people such as Annibale Raimondo (1505–1591), Cornelio Frangipane (1553–1643), Giuseppe Valdagno (second half of the sixteenth century), and Francesco Giuntini (1523–1590). However, although the theories presented by these Italian intellectuals are principally linked with the Aristotelian theory of terrestrial emissions, their efforts to comprehend the phenomenon often led to anti-Aristotelian positions. The combination of traditional and innovative proposals found in their theories became illustrative of the difficulty of providing a clear understanding of the celestial novelties.[45] The main interpretative lines

[45] For a detailed discussion on the importance of celestial novelties in the intellectual history of the late sixteenth century and early modern science, see Lynn Thorndike, *A History of Magic and Experimental Science* (New York:

around which the theories of the abovementioned authors are organised can be summarised by focusing on three diverse approaches towards explaining the heavenly body observed in 1572.[46]

The first is the identification of the nova with a star that already existed in the celestial region. In this case, the fact that it became visible was explained by pointing out the increase in luminosity, which was probably caused by vapours and emissions produced in the terrestrial region. This theory reflects the position of the Italian astrologer Annibale Raimondo, who identified the phenomenon with a star present in the catalogue of stars compiled by Ptolemy, rather than with a new star and, specifically, with the eleventh star in Cassiopeia.[47] Cornelio Frangipane held a slightly different position, but this was also founded on the belief that the star under investigation was the eleventh in Cassiopeia. In contrast to Raimondo, Frangipane stated that the visibility of the star was affected by changes in its position and size because of a conjunction of celestial bodies that caused it to come in and out of view. [48]

The second line of interpretation differs from the first in that it considers the new phenomenon to be a six-magnitude (or less) star that had gradually increased in luminosity and, therefore, was not one of the stars present in Cassiopeia. The increase in luminosity was again considered to have been caused by terrestrial emissions; however, it is still significant insofar as it argues that some celestial bodies can only be observed under certain conditions.

Macmillan, 1941), vol. 4, pp. 67–98; and C. Doris Hellman, *The Comet of 1577: Its Place in the History of Astronomy* (New York: AMS Press, 1971).

[46] Tessicini, *Il dibattito italiano sulla nuova stella del 1572,* pp. 43–94.

[47] A. Raimondo, *Discorso sopra la stella che il Novembre et Decembre 1572 ha reso tanta marauiglia a infiniti di diuerse nationi, e a gran parte d'essi fatto parlare tanto diversamente. Al sereniss. Principe et all'ill.mo et eccell.mo Maggior Conseglio di Venetia and Dichiarationi [...] contra quelli che hanno scritto che la stella delle maraviglie 1572 [...] fusse cometa, e non stella fissa*, s.e., s.l., 1573.

[48] C. C. Frangipane, *Discorso del s. Cl. Cornelio Frangipani sopra la stella, che è apparsa nell'anno 1572 in Tramontana, dove discorrendosi di che ella sia composta, si dicchiara grandissimi effetti, che deve apportare* (Venice: Domenico and Giovanni Battista Guerra, 1573).

The third point of view was more traditional, identifying the body as a comet. It is known that within Aristotle's natural philosophy, comets were not a factor of concern as far as the essence of the heavens was concerned; in fact, they pertained to the terrestrial region. Comets were nothing more than hot, dry emissions that ascended to the sphere of fire where they were ignited. It is no coincidence that comets were dealt with in the *Meteorologica*, the book in which Aristotle discusses phenomena that occurred in the atmosphere:

> Now when as a result of the upper motion there impinges upon a suitable condensation a fiery principle which is neither so very strong as to cause a rapid and widespread conflagration, nor so feeble as to be quickly extinguished, but is yet strong enough and widespread enough; and when besides there coincides with it an emission from below of suitable consistency, then a comet is produced, its exact form depending on the form taken by the emission.[49]

This understanding can be found in the works of Giuseppe Valdagno,[50] and Francesco Giuntini.[51] Despite signs of openness towards not strictly Aristotelian ideas, such as the optical interpretation of the phenomenon, to which Valdagno inclined when reflecting upon the visible features of the phenomenon, he did not develop the anti-Aristotelian implications of this interpretation. In Valdagno's work, comets continued to be thought of as meteorological phenomena located below the first celestial sphere; similarly, the supralunar location of these bodies was rejected by the astrologer Giuntini in accordance with Aristotle's theory of comets.

The problems with the interpretative lines presented here were underlined by Christopher Clavius (1538–1612) in his commentary on Johannes de Sacrobosco's spheres (*In sphaeram Ioannis de Sacro Bosco commentarius*) and, specifically, in a text added to the third edition of this work in 1585, which indicates the evolution of Clavius's thinking in response to the recent

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[49] Aristotle, *Meteorologica*, trans. by H. D. P. Lee, LCL 397 (Cambridge, MA: Harvard University Press, 1952), I, 7, p. 51.
[50] G. Valdagno, *Discorso intorno a la stella, che negl'ultimi mesi dell'anno 1572 è stata veduta con inusitato, et meraviglioso splendore* (Milan: Ambrosiana, ms R 95 sup.).
[51] F. Giuntini, *Discorso sopra la cometa apparsa nel mese di nouembre 1572* (Venice: Domenico Farri, 1573).

challenges posed by the new astronomical events.[52] In the period of about 10 years that separates the writings on the nova and the third edition of Clavius's *Commentarius*, he had had the opportunity to develop his ideas on the matter and probably to compare the European literature on the topic with his own thinking.[53] Before offering his new understanding of the phenomenon, he dwells on some theoretical issues that persisted within the positions embraced by the figures previously discussed. For example, as far as natural philosophy was concerned, the interpretive strands indicated do not explain why the changes affected only a single star rather than a whole section of the heavens and, in addition, did not reason how it was possible the body was visible in the same position across Europe. In fact, a significant parallax would have been expected when observing the phenomenon from different parts of the world because of the considerable distance between the star and the terrestrial emission. Moreover, as we will see later, theories that differed from the meteorological interpretation also emerged. For example, the identification of the body observed in 1572 as one of the stars already present in Cassiopeia had already been challenged by Francesco Maurolico (1494–1575), who believed not only that the star was in the upper region of the fixed stars and, therefore, in the heavens, but also that it was a new one.[54] The *pars costruens* of Clavius's idea about the body is compatible with Maurolico's interpretation of the star of 1572 as a new celestial body; this led Clavius to accept the possibility of changes in the heavens and so also begin to move towards accepting that a process of generation and corruption could occur in the heavens; however, he considers the body produced to be 'less corruptible' compared with the corruption that took place in the 'inferior realm'.[55] Consequently, the heavens maintained their ontological

[52] C. Clavius, *In Sphaeram Ioannis de Sacro Bosco Commentarius. Nunc tertio ab ipso auctore recognitus, et plerisque in locis locupletatus* (Rome: Domenico Basa, 1585), p. 191. Hereafter *Commentarius*.
[53] See D. Tessicini, *Il dibattito italiano sulla nuova stella del 1572*, pp. 49–52.
[54] F. Maurolico, *Super nova stella.: Que hoc anno iuxta Cassiepes apparere cepit considerationes*, [1572]; Cf. C. Doris Hellman, 'Maurolico's Lost Essay on the New Star of 1572', *Isis*, 51 (1960), 322–36.
[55] 'dicendum enim fortasse erit, caelum non esse quintam quandam essentiam, sed mutabile corpus, licet minus corruptibile sit, quam corpora haec inferiora', in Clavius, *Commentarius*, p. 194.

superiority over the terrestrial region.[56] More information on Clavius will be provided in Chapter 5 of this thesis, and it will look at the role he played within the Jesuit order and the importance of this religious order in the scientific debates.

This brief historical sketch of preceding Italian theories about the nature of comets is a part of the intellectual heritage inherited by Tassoni, who devotes *quesito* 7 of Book 2 of the *Pensieri diversi*, *Che cosa sieno le comete e come saliscano all'ottava sfera* (What comets are and how they reach the eighth sphere), to discussing the location and nature of comets. Tassoni's *quesito* on comets suggests that he should certainly be included among the group of thinkers who considered the new star observed in 1572 to be a comet. However, the celestial body is mentioned in a discussion that was aimed at opposing the theory of comets held by Aristotle. More precisely, the phenomenon that appeared in Cassiopeia is taken as proof that comets were not confined to the terrestrial realm. In fact, although Tassoni does not present a clear theory with regard to the essence of comets, he has no doubts about where they are situated: 'That comets pass through the circle of the moon and ascend to the eighth sphere is already accepted and evident in our time, despite the fact that some pushover philosophers still dare to deny mathematical demonstrations'.[57] Tassoni is in favour of comets being located above the Moon, that is in the celestial region; this is compatible with his argument that the heavens do not contain spheres and are instead comprised of an air-like substance. Indeed, this opened up the possibility that hot and dry emissions from the Earth (as comets were probably considered to be), or even celestial bodies themselves—the resistance of the heavens

[56] For more insights, see U. Baldini, *Legem impone subactis*, pp. 123–55; U. Baldini, *Saggi sulla cultura della Compagnia di Gesù (secoli XVI–XVIII)* (Padua: CLEUP Editrice, 2000), pp. 15–49; U. Baldini, *Christoph Clavius e l'attività scientifica dei Gesuiti nell'età di Galileo. Atti del Convegno Internazionale. Chieti, 28–30 aprile 1993* (Rome: Bulzoni, 1995); F. Favino, 'Clavio, il cosmo, il tempo', in *Magistri astronomiae dal XVI al XIX secolo. Catalogo della mostra, Roma nov. 2014–feb. 2015*, ed. by Nicolucci Valentina (Rome: De Luca Editori, 2014), pp. 31–45.
[57] 'Che le comete trapassino il cerchio della luna e salgono fino all'ottava sfera già è approvato e chiaro a' dì nostri, non ostante che alcuni filosofastri di stoppa ardiscano tuttavia di negare le dimostrazioni matematiche', in Tassoni, *Pensieri*, II, 7, p. 424.

notwithstanding—penetrated and moved throughout the celestial region: 'And because the celestial globes as subtle bodies, make the heavens turn with their continuous motion, the comets too, when they ascend there, are forced to follow that motion, as the clouds follow the motion of the wind'.[58]

Moreover, according to Tassoni, if Aristotle's conception of comets were true and they were emissions of hot and dry terrestrial matter that condensed and then ignited in the sphere of the fire, because of the nature of their matter, they should burn and, consequently, disappear quite rapidly. However, it was possible to observe comets shining in the sky for a considerable length of time:

> it is not realistic that fumes, which are pure, soft, hot, dry, and ready to burn all at once, like the powder of the cannon, would sustain a flame for such a long time, since we have seen comets that have lasted for whole years. And even more we see that falling stars and other impressions which are kindled in the air creep, flow and disappear in a moment, devoured by the flame, as soon as they are lit.[59]

The fact that comets existed for a long time was an argument widely used against their fiery nature in the early modern era. Most likely, it was spread from the works of the mathematician, astrologer, natural philosopher, and physician Girolamo Cardano (1501–1576).[60] In his *De subtilitate* (1550),[61] he states that comets are located in heaven and not lower down, in contrast to the idea they were emissions that had been ignited. In addition, Cardano

[58] 'E perché come corpo tenue i globi celesti col loro continuo moto lo fan girare [il cielo], anche le comete, quando vi saliscono, a secondar quel moto sono forzate, come secondano le nuvole il moto del vento', in Tassoni, *Pensieri*, II, 7, pp. 424–25.

[59] 'non è verisimile, che l'esalazione, che è cosa pura, tenue, calda, secca, e disposta ad arder subito tutta, come la polvere delle bombarde, mantenesse tanto tempo la fiamma, essendosi vedute comete che hanno durato gli anni intieri. E tanto più vedendo noi, che le stelle cadenti, e l'altre impressioni, che per l'aria s'accendono, subito accese strisciano, scorrono e spariscono in un momento divorate dalla fiamma', in Tassoni, *Pensieri*, II, 7, p. 425.

[60] For an account on Cardano as a natural philosopher, see Ingo Schütze, *Die Naturphilosophie in Girolamo Cardano's* De subtilitate (Munich: Fink, 2000); for a more general view on Cardano's life and works, see Marialuisa Baldi and Giulio Canziano (eds.), *Girolamo Cardano: le opere, le fonti, la vita* (Milan: Franco Angeli, 1999).

[61] Girolamo Cardano, *De subtilitate, libri XXI* (Nuremberg: Johannes Petreius, 1550). See also Girolamo Cardano, *De rerum varietate libri XVII: Adiectus est capitum, rerum et sententiarum notatu dignissimarum index* (Basel: Per Henrichus Petrus, 1557).

considers the luminosity and size of these celestial bodies to further reject the Aristotelian position in relation to comets. The following excerpt from Cardano's work is reported at length because it discusses ideas that seem to be echoed by Tassoni. In Book 4 of *De subtilitate*, in which Cardano deals with the luminosity of the celestial bodies, his theory of comets emerges:

> It is sufficiently established that the place that should be seen by an inhabitant of Milan under the winter circle is more than ten times as far from Earth as the height reached by the vapours. But comets are seen there by us, so they do not arise from vapours. Yet not higher up in the ether either, because there is no inflammable material there. But if you suggest that the stars' power seizes moisture and drags it up there, although the place is higher than the general location of vapours, the first obstacle is that most comets get beyond the second month, and some are not even over in the third, and the whole apparatus of Earth would not be enough for this conflagration. It was in fact shown previously that a fire never exists permanently in the same material, but needs fresh all the time. This fire is usually a star with a tail, and is in the ether, which is why it is no smaller than the Moon. It is quite impossible that so much material should be ablaze and last for three months. Furthermore, some are less conspicuous, being hidden before sunset, or do not move, and neither of these types has yet been seen […] But it is quite easy to discover whether there is a comet in the region of the elements, or one coming about in heaven: if it possess greater diversity than the Moon, it must be in the region of the elements, but if less, it must surely be in heaven.[62]

In the wake of Cardano, Tassoni rejects the argument according to which comets would show the same light and dimensions for long time because new matter is continually being added to fuel their combustion:

> And if it should be objected that comets can be kept burning for a long time by continuously adding new matter, I reply that comets appearing in the eighth region larger than any star should also be larger than the Earth. Therefore, if to such an abundance of burning fumes that exceeds the circuit of the whole Earth and of the sea one should always add such an abundance of new matter that for fifteen continuous months it would maintain the same fire, the same light, and the same size in it, as we have already seen in that [the comet] which appeared in the thigh of Cassiopeia in the year 1572, it would undoubtedly happen that the whole Earth and the sea would be converted into fumes; it is not realised above all that any

[62] Cardano, *De subtilitate*, IV, pp. 230–31. The quotations from Cardano's *De subtilitate* are drawn from Girolamo Cardano, *The 'De Subtilitate' of Girolamo Cardano*, ed. by John M. Forrester, vol. 1 (Tempe: Arizona Center for Medieval and Renaissance Studies, 2013).

matter of the kind that Aristotle describes, which rises to ignite in comets, ever falls to the bottom.[63]

Tassoni considers that to an observer, comets appear bigger than any other star, and this leads him to believe they are even bigger than the Earth. Consequently, he says, it is not reasonable to suppose an addition of matter without the absurd implication that the Earth and the seas themselves would be converted to emissions. In the light of the above, Tassoni embraces an optical interpretation of the phenomenon of comets, therefore reinforcing the criticism against Aristotle.

Optical theories

Through the mediation of the *novatores*, Tassoni aimed at developing a line of thought from ancient sources to modern ones that was persuasive with regard to the urgent need to revise the Aristotelian tradition. This was considered necessary because Aristotelian thinking was held responsible for having generated theoretical inconsistencies that had affected the comprehension of the natural world. In this sense, it should not be forgotten that during the the first half of the sixteenth century, a valuable alternative to the Aristotelian view of comets had already been developed: optical theories. While the Aristotelian account was still defended, investigations into new comets, which aimed to offer different and original interpretations, had already been undertaken during the 1530s. These investigations, led by Peter Apian (1495–1552) and Girolamo Fracastoro (1478–1553), focused on a comet's tail and its direction in order to understand the essence of these celestial bodies. For instance, Apian asserted that a

[63] 'E se si rispondesse, che le comete possano mantenersi lungamente accese coll'andarsi di continuo aggregando materia nuova, si risponde che le comete, che appariscono nell'ottava regione maggiori di qual si voglia stella conviene eziandio che sieno maggiori della terra. Però, se a cotanta copia d'esalazione accesa che supera il circuito della terra tutta e del mare si dovesse andare aggregando sempre tanta copia di nuova materia che per quindici mesi continui mantenesse l'istesso fuoco, l'istessa luce, e l'istessa grandezza in lei, come si vide già in quella che apparve nella coscia della Cassiopeia l'anno 1572, senza dubbio gli si converrebbe che tutta la terra e'l mare si convertissero in esalazione, non si discernendo massimamente che mai ricada a basso materia alcuna di quella che vuole Aristotile, che salga ad infiammarsi nelle comete', in Tassoni, *Pensieri*, II, 7, p. 425.

comet's tail was a reflection produced by the Sun. This idea became the origin of a valuable alternative to the Aristotelian view of comets.[64] Studies based on optics had a significant role in shaping new theories, and Cardano, in promoting his theory of comets, presented a detailed optical theory according to which he supported not only the location of comets in the heavens but also their celestial nature. The source employed by Cardano is Seneca, who in ancient times had already criticised the terrestrial nature of comets. In his *Naturales quaestiones*, one of the arguments used by Seneca to reject the conception of comets as fires relies on the fact that some comets were visible for a long time, which would not have been possible if they had originated from condensed air and were fed by combustible material, as the Stoics believed:[65]

> I do not agree with our people: for I think of a comet not as a fire that appears from nowhere, but as one of the eternal products of nature. In the first place, everything created from air is short-lived, for it is generated in an evanescent, impermanent substance […]. Then, if the fire stuck with its fuel, it would always descend, for air is thicker the closer it is to Earth. But comets never sink right down or get close to the ground [...] I was just saying that no fire that flares up in some impurity in the air is long-lasting. Now I am going further: it cannot last and stand still at all, for torches, and lighting-bolts, and shooting stars, and any other kind of fire ejected by air are on the run and are not seen except while they are falling. A comet has its own position, and so is not emitted swiftly, but measures out its course; it is not extinguished, but makes an exit.[66]

In Cardano's view, a comet is a sphere (*globus*) in the sky of a nature somewhere between the Moon and the stars, and when this sphere is illuminated by the Sun, its tail is formed: 'Hence it is quite clear that a comet is a round mass in heaven, which is seen to be lit by the Sun, and while the rays pass through it they create the likeness of a beard or tail'.[67]

However, Tassoni does not seem to embrace the theory of the celestial nature of comets. He appears to be more focused on emphasising their celestial location above the Moon, rather

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[64] See P. Barker, 'The Optical Theory of Comets from Apian to Kepler' *Physis* 30 (1993), 1–25.
[65] Seneca devotes Book 7 of his *Naturales quaestiones* to the discussion of theories on comets; see Seneca, *Natural Questions*, trans. by Harry M. Hine (Chicago: University of Chicago Press, 2010), pp. 115–35.
[66] Seneca, *Naturales quaestiones*, VII, pp. 128–29.
[67] Cardano, *De subtilitate*, IV, p. 233.

than developing a clear theory in relation to where they were formed. In fact, despite the fact that Tassoni mentions Girolamo Cardano and Heraclides Ponticus as being supporters of the optical theory of comets, and Tassoni's thinking appears to be very much in line with theirs,[68] his notion of the nature of these phenomena is, however, overtly inspired by Telesio.[69]

Compared with the meteorological theory of comets, the theory supported by Telesio in his treatise *De cometis et lacteo circulo* (1590)[70] appears to be 'more plausible' to Tassoni's eye:

> But as for the essence of comets I also consider false Aristotle's opinion and that of Telesio, if not true, much more likely at least. Aristotle says in chap. 8 of Book 1 of the *Meteore*, that the comet is nothing other than fumes condensed and ignited in the sphere of fire or in the uppermost region of the air. Telesio says in his treatise *Delle comete e della Via Lattea* that the comet is a globe of condensed and purified vapour, which without being ignited receives its image from the light of the Sun, and reflects it in the same way that the Moon does and that crowns and irises and other impressions described by Aristotle himself do. This was also held by Heraclides Ponticus among the ancients and, among the moderns, by Cardano.[71]

Telesio is also a supporter of the optical theory of comets, in which rather than being considered as bodies comprised of matter that has been ignited, comets are thought to be a

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[68] Doxographical works report Heraclides Ponticus's opinion; for example, the following example can be found in Plutarch's *De placitis philosophorum*: 'Heraclides Ponticus thought comets [lit. very high things][to be] cloud, illuminated by light from above. This man [thinks this to be] the cause of the bearded star, that is of the circle around the stars, of the beam, of the meteor, and of other similar appearances reasonably and as all Peripatetics [state]' (Heraclides Ponticus praealta nubem putat ab lumine supero illustratam. Hic causam affere pogoniae id est barbatae aeraeque et trabis et columnae et huiusmodi quomodo sane et omnes peripatetici), in Plutarch, *Plutarchi Cheronei de placitis philosophorum naturalibus libri quinq per magistrum*. (Rome: Iacobus Mazochiusm, 1510), III. fo. XX.

[69] Tassoni, *Pensieri*, II, 4, p. 425.

[70] During Telesio's lifetime the text remained unpublished. It was finally published in 1590 by Antonio Persio: Bernardini Telesii Consentini, *Varii de naturalibus rebus libelli ab Antonio Persio editi. Quorum alij nunquàm antea excusi, alij meliores facti prodeunt. Sunt autem hi De cometis, & lacteo circulo. De his, quæ in aere fiunt. De iride. De mari. Quod animal vniuersum. De usu respirationis. De coloribus. De saporibus. De somno. Unicuique libello appositus est capitum index* (Venice: Felice Valgrisius, 1590). Hereafter *De cometis*. Cf. B. Telesio, *Sobre los cometas y la Via Lactea*, trans. by M. Ángel Granada (Madrid: Tecnos, 2012).

[71] 'Ma quanto all'essenza delle comete pur io stimo falsa la opinione d'Aristotile, e quella del Telesio se non vera, molto più verisimile almeno. Dice Aristotile nel cap. 8 del I lib. delle *Meteore*, che la cometa non è altro che esalazione condensata ed accesa nella sfera del fuoco o nella suprema regione dell'aria. Dice il Telesio nel trattato *Delle comete e della Via Lattea* che la cometa è un globo di vapore condensato e purificato, il quale senza essere acceso riceve l'immagine dalla luce del Sole, e la riflette nella guisa che fa la Luna e che fanno le corone e l'iride ed altre impressioni descritte da Aristotile stesso. Il che parimente tennero Eraclide Pontico fra gli antichi e, fra i moderni, il Cardano', in Tassoni, *Pensieri*, II, 7, p. 425.

condensed and purified globe of vapours that receives its image from the light of the Sun and is reflected by it.[72]

The possibility of finding comets above the Moon is completely understandable within Telesio's system of natural philosophy. In his *De rerum natura*, he had already rejected the substantial difference between celestial and terrestrial matter, and in the *De cometis* his viewpoint is simply reinforced.[73] Consequently, the innovative aspect of Telesio's statement on comets was not so much their possibility of reaching the celestial region, rather the implication that the solid spheres, which we know were accepted by Telesio, were penetrable.[74] This also provides the reason why Tassoni limited Telesio's theory of comets to a status of plausibility rather than reality. We know that Tassoni disagreed with Telesio in that he rejected the existence of spheres in the heavens;[75] therefore, the parts of Telesian reasoning adopted by Tassoni were principally the notions that comets were not made of matter that ignited and that the heavens, which in Tassoni's view were made of an air-like substance, were penetrable.

Close to the end of the sixteenth century, the appearance of a new body visible in the sky was not an isolated phenomenon. The potential for change with respect to the Aristotelian cosmos was felt throughout Europe, especially because new phenomena (comets of 1577, 1580, 1585, 1590, and 1596) continued to affect ancient theories radically. If something

[72] 'cometas Solis omnino lux sit a vaporibus in se ipsos collectis relucens age igitur, num huiusmodi si ponatur, reliquia, quae cometis evenire visa sunt, evenire queant omnia, intueamur', in Telesio, *De cometis,* p. 2. For a detailed account of Telesio's theory of comets, see M. Ángel Granada, 'Telesio y las novedades celestes. La teoría telesiana de los cometas', *Ingenium: Revista electrónica de pensiamento moderno y metodología en historia de la ideas*, 3 (2010), 22–47; M. Ángel Granada, *Novas y cometas entre 1572 y 1618. Revolución cosmológica y renovación política y religiosa* (Barcelona: Universitat de Barcelona, 2012).
[73] Cf. Telesio, *De cometis*, p. 10.
[74] Cf. R. Bondì, *Il primo dei moderni: Filosofia e scienza in Bernardino Telesio* (Rome: Edizioni di Storia e Letteratura, 2018).
[75] See Chapter 3, Section 3.3.

unusual could be seen above the Moon, the whole idea of the cosmos then was called into question.[76]

Steps towards a new cosmological vision

The optical theory of comets was an important alternative to the Aristotelian meteorological theory. Highly successful in Europe, it was well regarded by both Brahe and Kepler. Brahe's observations of the 1577 comet, as well as those of the later one in 1582, showed that the tail was directed away from Venus; therefore, the light emanating from the planet would generate an effect opposite to the antisolar direction of the comet's tail, which is considered by Brahe to be more natural.[77] Furthermore, Brahe claims comets' tails are not real extensions of comets themselves, but just optical phenomena. Among Brahe's interlocutors was Christoph Rothmann (1555–1610).[78] Rothmann's account of comets is quite critical of Brahe's conclusions, especially with regard to the composition of the celestial matter. In accordance with Rothmann's observations of and studies on the 1585 comet, the occurrence of refraction confirmed there was no substantial difference between the celestial matter and the substance from which the sublunar region was formed: the matter that occupied the space between the Earth and the firmament was the air and comets were simply balls of vapour given off by the Earth and responsible for the refraction, which constituted the phenomenon of the comet. In other words, Rothmann's view is in contrast to Brahe's claim that the refraction was due to the difference in density between the ether (lighter) and the air (denser) and, therefore, he refutes the existence of the quintessential matter still accepted by Brahe. In point of fact, this theory

[76] For an account of the intellectual output representative of the cosmological evolution of the late sixteenth century, see M. Ángel Granada, *El debate cosmológico en 1588. Bruno, Brahe, Rothmann, Ursus, Röslin* (Naples: Bibliopolis, 1996).
[77] For more details on Tycho Brahe and his observation of comets (1577), see J. R. Christianson, 'Tycho Brahe's German Treatise on the Comet of 1577: A Study in Science and Politics', *Isis*, 70 (1979), 110–40.
[78] Bruce T. Moran, Christoph Rothmann, the Copernican Theory, and Institutional and Technical Influences on the Criticism of Aristotelian Cosmology', *Sixteenth Century Journal* 13 (1982), 85–108.

was already supported by the Parisian Jean Pena (1528–1558), who was among the first to develop his idea of comets as being bodies denser than air and whose pyramid-shaped tail was due to the refraction of the solar rays. This idea was developed from the prerequisite that the air was the medium in which these phenomena occurred. More precisely, the air was not considered to be just an element of the inferior terrestrial realm; rather, it was thought that it reached the higher celestial region as far upward as the fixed stars. Pena considered the heavens themselves to be made of air. In fact, he rejected not only the solid celestial spheres and the existence of the sphere of fire, but also the Aristotelian theory of the quintessential matter.[79] As far as the composition of the celestial region was concerned, the only difference in Rothmann's thinking was that it was presented in terms of difference in perfection, a position that matches Tassoni's line of thought very well.

Brahe, Rothmann, and Tassoni himself all agreed about the fluidity of the heavens and considered comets to be compelling evidence of this (despite their different ideas about the essence of comets). As Brahe explained in letter to Kepler, 'I think that all reality of the spheres must be excluded from the heavens […] as attested by […] the true matter of the comet and the ether and the new star of 1572 that is the ether'.[80] These three theorists' conception of the heavens, therefore, requires accepting fluid heavens – heavens that are not constrained by any sphere so that there is no obstacle to the motion of planets, which is regulated only by the wisdom of God; there is no auxiliary machinery, such as moving spheres.

As far as Kepler is concerned, it is opportune to recall his scepticism with respect to the optical theory before considering his partial acceptance of it in about 1604.[81] Kepler's initial

[79] For Pena's theory of comets, see Euclid, *Euclidis Optica & catoptrica nunquam antehac Graece aedita eadem Latine reddita per Ioannem Penam [...]; his praeposita est eiusdem Ioannis Penae de vsu optices praefatio* (Paris: Andreas Wechelus, 1557).
[80] 'Ego omnem orbium realitatem […] coelo eliminandam censeo, quod […] cometae re vera aetherei, inde a nova stella a. 1572 conspecti', in Johannes Kepler, *Joannis Kepleri astronomi opera omnia*, 9 vols., ed. by Ch. Frisch (Frankfurt and Erlangen: Heyder and Zimmer), I, p. 44.
[81] Cf. J. Kepler, *Ad Vitellionem paralipomena, quibus astronomiae pars optica traditur; potissimùm de artificiosa obseruatione et aestimatione diametrorum deliquiorumque solis et lunae. Cum exemplis insignium eclipsium.*

criticism of Pena's theory is softened when he accepts that comets are glasslike spheres situated above the Moon. More precisely, Kepler accepts that their shining tails were due to the encounter between the solar rays and the head of the comet that was a kind of matter different from the ether, denser, and, thus, visible when illuminated by the Sun. In addition, if the tail were simply due to the reflection of the Sun through the comet, it was to be expected that all the tails would point away from the Sun in a straight line. However, this did not happen because the tail was not made of ignited matter; rather, it was made of material ejected from the head. This material determined the shape of the tails, which were simply illuminated by the Sun, and this explains the curvature of some comets' tails.

Kepler's viewpoint offers further confirmation that the debate about the correct interpretation of the celestial novelties was complex. In Italy, however, there was still little systematic work in the field of planetary astronomy, and so, as we have seen, the traditional position still often dominated.[82] Raimondo's opinion was considered by Brahe to be representative of the cultural backwardness that characterised Italian thinkers. As modern scholarship testifies, Brahe reported debates between Raimondo and his interlocutors, people such as Cornelio Frangipane, Thaddaeus Hagecius, and Giovanni Battista Benedetti, in his *Astronomiae instauratae progymnasmata* (1610), the work that more fully conveys his ideas on the celestial phenomena.[83] Moreover, close to the end of the sixteenth century and as will

Habes hoc libro, lector, inter alia multa noua, tractatum luculentum de modo visionis et humorum oculi vsu, contra opticos et anatomicos, authore Ioanne Keplero [...] (Frankfurt: Claudius Marnius et haeredes Ioannis Aubrii, 1604).

[82] Cf. U. Baldini, 'La teoria astronomica in Italia durante gli anni della formazione di Galileo: 1560–1610', in *Lezioni galileiane I. Alle origini della rivoluzione scientifica*, ed. by Paolo Casini (Rome: Istituto della Enciclopedia Italiana, 1991), pp. 39–67.

[83] T. Brahe, 'Astronomiae instauratae progymnasmata', in T. Brahe, *Opera omnia*, ed. by J. L. E. Dreyer (Amsterdam: Swets & Zeitlinger, 1972). For us, this is an invaluable instrument from which to obtain information about the *status quaestionis* of the topic.

be discussed in Chapter 5, Tycho Brahe developed a new world system (*systema mundi*), different from both Aristotelianism and Copernicanism: a geoheliocentric system.[84]

So far, the focus on the evolution of cosmology has been concerned with the achievement in relation to the celestial region: over a period of approximately 30 years the fluidity of the heavens became widely accepted, and the planet–bird analogy, which can be found in Ptolemy's work,[85] and had already been used by Bellarmino in his Louvain Lectures (although unpublished until recently),[86] found a new context (devoid, this time, of any mechanisms such as spheres, eccentrics, and epicycles): the stars were conceived of as self-moving objects in the sky like birds in the air. Tassoni's cosmological theory fits this context admirably:

> And it is not necessary here for the sharpest minds to search for an explanation of how the celestial globes are lifted up in an empty area without ropes or chains, in so far as we can see that birds and comets are also there and move regularly with unceasing motion for as long as they last, and that the mass of earth and water, so heavy and weighty by nature, not having anything but air, is suspended and motionless eternally without hooks or props [...]. This is its place [the place of the mass of earth and water], these [the celestial globes] is that of the stars; in this it [the mass of earth and water] rests, and in that they [the stars] go eternally, revolving according to their nature.[87]

Tassoni's cosmological system is the result of his command of those natural principles that assign to each body a proper place in which to reside with respect to the natural features of other bodies. Section 4.3 will provide more details about Tassoni's cosmological order. To obtain an all-encompassing picture of Tassoni's cosmological view, it is now necessary to focus on the terrestrial region. How many elements comprised what was known as the inferior

[84] For the evolution of Brahe's system of the world, see V. E. Thoren, 'The Comet of 1577 and Tycho Brahe's System of the World', *Archives internationales d'histoire des sciences*, 29 (1979), 53–67.
[85] Cf. Ptolemy, *Opera quae exstant omnia* (Leipzig 1898–1952), II, 119/21–31, 120/6–16.
[86] Cf. Grant, *Planets, Stars, and Orbs*, pp. 348–51.
[87] 'E non occorre che qui gli ingegni acuti cerchino ragione come i globi celesti stieno sollevati in un campo vano senza funi o catene, mentre veggiamo che gli uccelli e le comete vi stanno anch'elle e si muovono regolarmente con incessabile movimento per quanto durano, che la massa della terra e dell'acqua, così grave e pesante di sua natura, non avendo da parte alcuna altro che aria, senza uncini o puntelli sta sospesa e immobile eternamente [...]. Questo è il suo luogo, quegli è quel delle stelle; in questo ella si posa e in quello esse vanno eternamente per loro natura girandosi', in Tassoni, *Pensieri*, II, 3, p. 416.

reign? Where were they located and why were they necessary? The answers to these questions will inform this section.

4.3 THE TERRESTRIAL REGION

Earth and water

This section presents Tassoni's vision of the sublunary region by focusing both on its elemental composition and on its cosmological relevance. We are well acquainted with the dominant Aristotelian representation of the terrestrial region, which is comprised of four elements arranged in concentric spheres. The Earth's sphere occupies the centre of the universe and is surrounded by the Earth-centred spheres containing the other three elements: water, air, and fire, in that order: 'air and water each have both lightness and weight, water sinks beneath everything save earth, and air rises to the top of everything save fire'.[88]

Since the Middle Ages, however, the relationship between the Earth's sphere and the sphere of water had required more investigation to overcome the problem of understanding the spherical shape of the Earth. The possibility of there being a sphere of water that encircled the Earth's sphere without submerging it completely was questioned more widely, and according to Aristotelian thinking, it was hard to explain the undeniable presence of landmasses. In fact, if the Aristotelian disposition of the elements in the sublunary world were correct, the water would entirely cover the Earth such that this being much heavier than water, it should sink to the bottom. This is expressed well by Sacrobosco in his *De sphaera*, in which he mentions the dry lands that emerge from water:[89]

[88] Aristotle, *On the Heavens*, IV, 5, p. 361. On the theory of the elements supported by Aristotle, see also *Meteorologica*, mainly Book 1 and Book 2.
[89] For a detailed insight into the topic, see Edward Grant, *In Defense of the Earth's Centrality and Immobility: Scholastic Reaction to Copernicanism in the Seventeenth Century* (Philadelphia: American Philosophical Society, 1984).

> The elements are also simple bodies that cannot be subdivided into parts of diverse forms and from whose commixture are produced various species of generated things. Three of them in turn, surround the Earth on all sides spherically, except insofar as dry lands stay the sea's tide to protect the life of animate beings.[90]

In essence, Sacrobosco's statement that the Earth's landmass emerged from the water suggested the existence of the so-called terraqueous globe: a globe comprised of both water and the Earth. This was able to explain the presence of landmasses and also the reason why the Earth was not a perfect sphere: its form was, indeed, also determined by the presence of mountains and similar prominences that compromised, even if not drastically, its spherical shape. It is clear, therefore, that the Aristotelian model of concentric spheres needed to be revised with respect to the terrestrial region too. Nevertheless, despite different interpretations that tried to overcome the gap in Aristotelian physics either by appealing to divine providence, or simply by explaining that the landmasses emerged from the water because this latter element was much more abundant than the Earth, it was not until the sixteenth century that the idea of a unique sphere containing the two elements found a clearer definition. However, the theory that water and the Earth were two separate spheres remained dominant in the thinking of Scholastics and natural philosophers for a long time, and it took centuries before a wider understanding of the terraqueous globe emerged and this line of thinking was accepted.[91]

The arrangement of water and the Earth in the cosmos and their mutual relationship was discussed in an innovative way with respect to the Aristotelian theory of the elements by the natural philosopher Alessandro Piccolomini, who devoted an entire book to this topic. It was entitled *Della grandezza della terra e dell'acqua* and was published in Venice in 1558. Piccolomini rejected the theory that the elements formed concentric spheres, but he promoted

[90] Johannes de Sacrobosco, 'The Sphere of Sacrobosco', in *The Sphere of Sacrobosco and Its Commentators*, trans. by Lynn Thorndike (Chicago: University of Chicago Press, 1949), p. 119.
[91] Cf. Grant, *Planets, Stars, and Orbs*, pp. 626–37.

the idea of the terraqueous globe, and demonstrated the predominance of the Earth over water in the universe.[92] The text written by Piccolomini was very successful, and it became a source of reference widely employed by those who dealt with the theme of the reciprocal relationship between water and the Earth. For example, in Clavius's *Commentary on Sacrobosco's 'De sphaera'* (1570), he devoted an entire question to discussing the following: Whether one globe only is formed by the water and the Earth, that is, whether the convex surfaces of these elements have the same centre?

The evolution of the conception of the terrestrial spheres offers the background against which to understand the relevance of those questions in Tassoni's work that focus on the elemental composition of the terrestrial region. In general, the presence of *quesiti* that focus on discussing the elements, further supports my initial statement that discussed the possibility of not only being able to extract Tassoni's particular system of natural philosophy from the *Pensieri diversi* per se, but of being able to provide a comprehensive coverage of those topics fundamental to constructing a solid theoretical nucleus that will showcase Tassoni's conception of the cosmos and indicate his original contribution to the cosmological debates of his time.

In Tassoni's *quesito* 12 of Book 4 of the *Pensieri Diversi*, *Per che cagione la terra e l'acqua stieno unite al centro del mondo* (Why earth and water are united at the centre of the universe), Clavius emerges as a significant source. The irrefutable presence of landmasses emerging from the water as indicated by Sacrobosco was interpreted by Clavius as evidence of the existence of a terraqueous globe. Accordingly, Tassoni's viewpoint is in line with the new thinking current at the time: the Earth and the water constitute one single sphere.[93] By echoing

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[92] This question had significant historical implications linked to the correct interpretation of the centre of the world; it was also addressed by Copernicus in his *De revolutionibus orbium celestium* (III). For an interesting study on this topic, in which Alessandro Piccolomini's ideas are presented, see Simone Mammola, *Il problema della grandezza della terra e dell'acqua negli scritti di Alessandro Piccolomini, Antonio Berga e G. B. Benedetti e la progressiva dissoluzione della cosmologia delle sfere elementari nel secondo '500* (Berlin: Max Planck Institut für Wissenschaftsgeschichte, 2014).

[93] See Tassoni, *Pensieri*, IV, 12, pp. 499–500; IV, 14, p. 503.

theories found in Sacrobosco's *De sphaera* and Clavius's *Commentarius*, Tassoni supports his theoretical decision and confutes the Aristotelian theory of place, used to support the traditional opinion. In opposition to Aristotle, Tassoni restated that if the sphere of water were located above the Earth, the water would be characterised by an upward motion and, therefore, the landmasses would sink into the sea and the surface of the Earth would be completely covered by water. The simple everyday experience of the behaviour of water, which, in fact, moves downward, appears sufficient for Tassoni to label this idea as absurd. In addition, to undermine the two-sphere system of water and the Earth further, Tassoni uses the argument of the incompatibility of the roundness of the water with the positioning of this element in a sphere above the Earth, an argument that had already appeared in Sacrobosco's work.[94] In fact, by drawing on the experience of sailors, Sacrobosco proved the roundness of the water by discussing the notion of a signal, 'set up on the coast', which a sailor sees from a ship after it has moved away from port:

> That the water has a bulge and is approximately round is shown thus: Let a signal be set up on the sea coast and a ship leave port and sail away so far that the eye of a person standing at the foot of the mast can no longer discern the signal. Yet if the ship is stopped, the eye of the same person, if he has climbed to the top of the mast, will see the signal clearly. Yet the eye of a person at the bottom of the mast ought to see the signal better than he who is at the top, as is shown by drawing straight lines from both to the signal. And there is no other explanation of this thing than the bulge of the water.[95]

Because of the roundness of the water, the signal can only be seen by the sailor if he climbs up to the top of the mast. Tassoni accepted Sacrobosco's statement and emphasised that if the water were above the Earth, in a separate sphere, the opposite would happen; namely, the view of the port would improve when the ship was further away from it: 'if water were higher

[94] Tassoni, *Pensieri*, IV, 13, p. 500.
[95] Sacrobosco, 'The Sphere of Sacrobosco', p. 121. Cf. C. Clavius, *In Sphaeram Ioannis de Sacro Bosco Commentarius*, ed. by Eberhard Knobloch, reprint of the Mainz 1611 edition (Hildesheim: Olms-Weidmann, 1999), p. 56.

than earth, the entire opposite would follow of what Sacrobosco said in his *Sphera*, where he proves the roundness of the element of water'.[96]

Here, Tassoni echoes an argument found in Clavius's *Commentarius*, where the existence of the sphere of water situated above the Earth is disproved. The argument concerns the movement of ships. Clavius writes, 'if water [and earth] […] was [were] not equally distant from the center of the universe, […] given the same wind, the ship would more swiftly sail back towards the harbour than sail out of the harbour'.[97] Likewise, Tassoni observes:

> if water rose above earth, in departing from the shore it [the ship] would ascend towards the summit of the water against the natural motion of heavy things and, coming towards it [the shore], it [the ship] would descend as down a slope, following the natural impetus and motion of the water.[98]

It is interesting to note how Tassoni, as is customary, focuses on philosophical arguments founded principally on common sense and practical experience that were already present in his sources. However, these were often enriched by mathematical and technical discourses, as in his use of Clavius, for example.

Similar to Clavius, Tassoni concludes there must only be one sphere comprised of both earth and water. These two elements, linked to the air, contribute to the creation and preservation of mixed bodies, whereas 'if the one [water] were above the other [earth] in such a way that oppressed it [earth], the latter could not contribute to the generation or mixture of anything outside of itself, because the other [water] would not allow it to do so'.[99]

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[96] 'se l'acqua fosse più alta della terra, seguiterebbe tutto il contrario di quello che disse il Sacrobosco nella sua sfera, là dove ei prova la rotondità dell'elemento dell'acqua', in Tassoni, *Pensieri*, IV, 13, p. 501.

[97] 'cum aqua […] non aequaliter distet a centro universi […] navis […] aequali existente vento, velocius ad portum descenderet, quam ex portu ascenderet', in Clavius*, In sphaeram Ioannis de Sacro Bosco commentarius. Nunc quartò ab ipso auctore recognitus et plerísque in locis locupletatus* (Lyon: Fratrum de Gabiano, 1593), p. 134.

[98] 'alzandosi l'acqua sovra la terra, nel partirsi dal lido si salirebbe verso il sommo dell'acqua contro il moto natural delle cose gravi e, venendosi verso di lui, si calerebbe come giù per lo chino, secondando l'impeto naturale e il moto dell'acqua', in Tassoni, *Pensieri*, IV, 13, p. 501.

[99] 'Se l'una sovrastesse in guisa ch'ella opprimesse l'altra, l'oppressa non potrebbe concorrere alla generazione o mistione di alcuna cosa fuora di sé percioché l'altra non le darebbe il passo', in Tassoni, *Pensieri*, IV, 13, p. 501.

The acceptance of the terraqueous globe within Tassoni's overall organisation of the world also leads to the subject of the distribution of the two elements within the sphere. If the notion of a spherical universe whose centre coincided with the centre of the Earth was accepted unanimously, and if it was also accepted that the Earth and the water belonged to the same sphere, the next question was which of these two elements coincided with the very centre of the universe?[100] To answer this, the way in which the two elements interacted needed to be taken into account. The matter was resolved by Clavius, and by Piccolomini before him, both men claiming the predominance of the Earth. However, they also stated that the centre of the universe was located at the centre of both the Earth and the water. The explanation for this was that even though the Earth was the dominant element, because each of the two elements was considered to be a reciprocal extension of the other and, moreover, because they were irrevocably joined together, the centre of the universe was actually in both, that is, in a mass of both the Earth and water in the combined terraqueous globe. Naturally, such a statement required that two of the other theories had both to be declared erroneous, first, the one that places the centre of the universe in the Earth and, second, the one that, in the wake of Plato, states it is in the water.[101] With this aim in mind, Tassoni briefly retraces the key concepts of the debate.

Aristotle's followers claim the Earth is the heaviest of the elements and, therefore, it falls downward and occupies the centre of the universe, according to Tassoni. He reports that according to these thinkers, the Earth's greater heaviness, compared with water, can easily be proved simply by observing that when a handful of earth is thrown into water, the earth sinks:

> They [the supporters of the theory according to which earth is heavier than water] will demonstrate that earth is heavier [than water] not only by mentioning the authority of the whole Peripatetic school, but also by showing that when earth is thrown into water, it immediately sinks into it. They will add that in the deepest

[100] See Grant, *In Defense of the Earth's Centrality and Immobility*, 1984.
[101] Tassoni, *Pensieri*, p. 502.

> depths of the sea there is earth, whereas in the deepest depths of earth it cannot be proved that there is water.[102]

Moreover, the Aristotelians point out that earth can be found at the bottom of the sea; however, they claim there is no water in the bowels of the Earth.

Curiously, to support the traditional representation of the cosmos, Tassoni also included an excerpt from a short, scientific poem attributed to the very popular Virgil. The poem, which clearly was intended to convey information, was entitled *Aetna* and dealt with volcanic phenomena. Tassoni quoted an excerpt that conveys the traditional image of the (geocentric) cosmos 'divided into sea and lands and stars',[103] in which the Earth, which is considered to be composed of solid matter, is surrounded by water, and the Earth and water are dominated by the starry sky.

However, Tassoni offers counter-arguments to these statements. First of all, he points out that earth falls downward into water not because it is heavier than the latter, but rather because of the different consistency of the two elements: the water, which is fluid and thin, lets earth, a dense body, pass through it. On the other hand, water itself, poured upon earth, seeps through

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[102] 'Che la terra sia più grave, oltre l'autorità di tutta la scuola peripatetica, lo mostreranno colla terra che si gitta nell'acqua, che in essa subito si profonda. Aggiungeranno che nel profondissimo fondo del mare si trova terra, dove nel profondissimo fondo della terra non si può provare che sia l'acqua', in Tassoni, *Pensieri*, IV, 14, p. 502.

[103] '*diviso corpore mundi / in maria ac terras et sydera*', in Tassoni, *Pensieri*, IV, 14, p. 502. It is most likely that Tassoni's reference to this minor pamphlet attributed to Virgil comes from his knowledge of Ludovico Castelvetro's works and his interest in Provençal studies. Of particular importance would have been the literary controversy that occurred between Ludovico Castelvetro and Annibale Caro in 1557. Castelvetro criticised the style, language, and content of Caro's *Venite all'ombra de' gran gigli d'oro*, a song written in praise of French monarchy. In response to Castelvetro's criticism, Annibale Caro wrote *Apologia de gli Academici di Banchi di Roma*, which contains the Virgilian excerpt quoted by Tassoni. See Annibale Caro, *Apologia de gli Academici di Banchi di Roma, contra m. Lodouico Casteluetro da Modena* (Parma: Seth Viotto, 1558), p. 80. Tassoni's reference to this book sheds light on his use of literary sources within the context of scientific disputes, a topic that requires further investigation. For preliminary insights into Castelvetro's influence on Tassoni, see Emilio Russo, 'Castelvetro nel primo Seicento (Tassoni, Marino, Stigliani)', *Atti e memorie dell'Arcadia*, 2 (2013), 121–38. For the dispute between Castelvetro and Caro, see Elena Bilancia and Samuele Reggiani, 'Polemica tra Annibale Caro e Ludovico Castelvetro', *Polemiche Letterarie del Cinquecento* (Polet500) (Ururi: Al segno di Fileta, 2018). For an overview of Provençal studies, see Santorre Debenedetti, *Gli studi provenzali in Italia nel Cinquecento e tre secoli di studi provenzali*, ed. by Cesare Segre (Padua: Antenore, 1995). For an English translation of *Aetna*, see Virgil, *Aetna*, ed. by H. A. J. Munro (Cambridge: Deighton Bell, 1867), and for an insight on the scientific significance of this text, see Stefania Santella, 'L'Aetna, App. Verg. Scienza ed Etica', in *Scienza antica in età moderna. Teoria e immagini*, ed. by Vanna Maraglino (Bari: Cacucci, 2012), pp. 376–87.

it to the centre.[104] In addition, Tassoni invalidated the argument maintaining the lack of water in the bowels of the Earth; he stated, 'even in the deepest recesses of the Earth, water is found and the deeper the recess, the greater the amount of water found there'.[105] In fact, according to Tassoni, water is found deep in the core of the Earth. Patrizi agrees with this, and his presence subtly re-emerges within Tassoni's scientific production, even if he does not appear among Tassoni's explicit sources.

Patrizi devotes his theory of the elements entirely to opposing the Aristotelian assumptions.[106] As far as water is concerned, Patrizi stresses that the evidence for the existence of water in the bowels of the Earth clearly demonstrates the inconsistencies in the Aristotelian cosmological order of the elements:

> [According to the Aristotelians] water, because of its gravity [heaviness], should naturally tend to descend downward, but always so that to be located on the surface of the Earth, in accordance with its natural place, [that is] at the boundary between the Earth and the air. If this is true, why does so great force of the waters is found under the Earth, in a place which is certainly not their natural place? And why is this force imposed by nature, and have nor the earth neither the nature provided for filling up those cavities, so that the waters should not be forced there?[107]

Furthermore, according to Tassoni, a higher density does not correspond to a higher weight; therefore, the greater heaviness of earth cannot be a result of its greater density compared with the density of water. To support his assumption, Tassoni pointed out that the density of diamonds and jewellery is greater than the density of lead, but the latter is clearly heavier than the former objects. In addition, among metals, quicksilver is liquid and very

[104] Tassoni, *Pensieri*, IV, 14, p. 502.
[105] 'anche nelle profondissime cave della terra si ritrova acqua e che quanto più profonda si fa la cava, tanto maggior copia d'acqua vi si ritrova', in Tassoni, Ibidem.
[106] For an overview of Francesco Patrizi's refusal to accept the Aristotelian doctrine of the elements, see C. Vasoli, 'La critica di Francesco Patrizi alla dottrina aristotelica degli elementi. Il fuoco, l'aria e l'acqua', *Rinascimento* 5, 47 (2007), 93–106.
[107] 'Aqua sane gravitate deorsum motum ciere naturaliter: sed ita ut locus a natura ei sit status in superficie terrae, in confinio terrae et aeris, ut terrae supernatet, ut aeri subsideat. Si id verum est, cur sub terra tanta vis aquarum, loco illi non naturali semper reperitur? Cur illi ista vis a natura infertur? Cur terra ea loca non implevit, ne natura vim pateretur?', in Patrizi, *Discussiones*, p. 454.

similar to water but, nevertheless, it is heavier than many other metals or bodies that have greater density.[108] In fact, as far as Tassoni is concerned, the Aristotelian theory of place does not demonstrate that the centre of the universe is in the Earth.

To reinforce his idea, Tassoni also refers to Telesio's book *De mari*, in which the author argues that earth is not found at the bottom of the sea but, as Tassoni says, 'the source of the sea itself, that is the place from which the salty water derives'.[109] The Telesian statement is in contrast to the ancient theory, supported by Aristotle, which considers the sea to equate with the element of water by claiming that water originates from the sea:

> The reason that made our predecessors think that the sea is the primary and main body of water is that they thought it reasonable to suppose that what was true of the other elements must be true of water. For of each of them there is one mass that is primary because of its volume, and from which come those parts of it that change and are mixed with the other elements: thus there is a mass of fire in the upper regions, of air in the region beneath that of fire, and the main body of the Earth round which it is obvious that the other two lie. Clearly, therefore, we must look for something analogous to water. But there is no obvious single mass of water, as there is of the other elements, except the sea. For the water of the rivers is neither a single mass nor standing, but appears to change continuously from day to day. It was this difficulty that led people to suppose that the sea was the primary source of moisture and of all water.[110]

The Aristotelians held that water occurred on the surface of the Earth, and explained that this appeared to be salty water (the sea) simply because the sweetest parts of the element (the fresh water) had evaporated under the action of the Sun. Consequently, because of its relationship with the Earth, the remaining part (the sea), which is salty *per accidens*, occupied the place where the fresh water should have been:

> The fresh and sweet water, then, as we said, is all drawn up because it is light, whereas the salt water remains because it is heavy, but not in its own natural place.

[108] Tassoni, *Pensieri*, IV, 14, p. 502.
[109] 'i fonti del mare istesso, da' quali scaturisce l'acqua salsa di sua natura', in Tassoni, *Pensieri*, IV, 14, p. 502. Cf. Telesio, *De iis quae in aere fiunt et de terraemotibus*. *De Mari*, transl. by Francesco Martelli and ed. by Luigi De Franco (Cosenza: Editoriale Bios, 1990), pp. 73–87.
[110] Aristotle, *Meteorologica*, II, pp.131–33.

> For this is a difficulty which may be properly raised (for it would be unreasonable that water should not have its natural place like the other elements) and its solution is as follows: The place which we see the sea occupying is not really its natural place but rather that of water.[111]

By contrast, Telesio aimed to demonstrate that all types of water, salty or fresh, are derived from the Earth and that salinity, therefore, was a unique feature of the sea.

However, Tassoni's reference to *De mari* is deprived of its context and his use of Telesio has to be considered simply as further evidence to reinforce the idea about the union of water and earth in one single sphere, rather than being read as his acceptance of Telesio's theory of the elements (Tassoni's idea of the water itself is different from the Telesian one).[112] More precisely, according to Telesian thinking, the strong connection between water earth can easily be understood: if water itself springs from earth, how can the two elements be separated in two different spheres?

Before Tassoni concludes his reasoning, orientated towards demonstrating that the centre of the universe is in both the earth and the water, he contrasts the opinion of those who consider the centre of the universe to be only in the element of water with his own thinking.[113] Tassoni reports that the main argument to support this idea is based on the difference in weight when comparing the same quantities of mud and dust: the greater heaviness of the first is ascribed to the water it contains. Thus, it is claimed that the water is heavier and, consequently, is the centre of the universe. The sources mentioned in support of this view are the words of David (Psalm 24), in which he mentions the creation of the Earth by God ('For he had founded it upon the seas, and established it upon the floods'; 'super maria fundavit et super flumina firmavit eum') and Plato's *Phaedo*. In the first instance, God's intervention in allowing land masses to

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[111] Aristotle, *Meteorologica*, II, p. 137.
[112] According to Telesio and different from Tassoni, water is formed by the action of the Sun on the Earth and, therefore, it must be considered warm rather than cold. See Telesio, DRN, II, 23 pp. 276–82; Cf., Telesio, *De rerum natura iuxta propria principia, libri IX*, III, 25, pp. 117–20.
[113] Tassoni, *Pensieri*, IV, 14, pp. 502–03.

emerge from the water is emphasised; in fact, without land it would not be possible to have and preserve life. In the latter, the Tartarus, which represents the origin of all water, as also polemically reported in the *Meteorologica* by Aristotle,[114] is considered to be the cavity at the centre of the Earth where all kinds of waters are gathered together, so preventing the Earth from sinking in water. Both these sources, therefore, provide the image of a sublunary world where water is the predominant element. This would have covered the Earth's sphere more or less entirely, and in the first case, without the intervention of divine providence would have impeded habitability and life, the same being true in the second case, if the Earth's surface were perfectly polished and devoid of cavities such as the Tartarus mentioned by Plato.

Furthermore, the identification of the centre of the universe with water was also supported by those who considered it was the place furthest from the heavens; thus, it had to be the most unlike them. For those like Tassoni who considered the heavens to be hot, the coldness of the water was a good point in favour of its being the location of the centre of the universe. Tassoni mentions Alexander of Aphrodisias when considering coldness to be a formal characteristic of water and also agreed with the way of reasoning according to which the centre of the universe should be that which was the most different to the heavens. However, Tassoni did not believe that the coldness of water justified it being the location of the centre of the universe. In reality, a more detailed consideration of the features of both water and earth shows the Earth to be a more reasonable location for this. In point of fact, earth appears to be the element majorly different from the heavens. The heavens are hot, bright, and perpetually in motion; earth, like water, is cold, but different to water, which moves *per accidens*,[115] earth is also motionless and dark. In addition, Plutarch considered earth to be the coldest element, representative of the

[114] Aristotle, *Meteorologica*, II, 2, p. 139–43.
[115] Tassoni discusses this topic in *quesito* 5 of Book 1 of the *Pensieri Diversi*, *Se il freddo muova* (Whether the cold can generate motion), see *Pensieri* I, 5 pp. 389–92.

principle of cold itself. Therefore, as far as its characteristics were concerned, it was clear that earth was the element completely opposed to the heavens.[116]

The overview provided by Tassoni finally led him to present his own thinking about the centre of the universe, which is a synthesis of the two alternatives discussed. According to Tassoni, the centre of the universe is in both earth and the water and, more precisely, it is in the coldest part that is made up of both elements, namely, the ice-cold mud:

> I would say that just as the surface of one [water] does not push forward that of the other [earth], so the center of the universe is not more in one than in the other [element], but is equally in both, and in that part of both which prevails in cold. Mud is a compound of water and earth; but it is not excessively cold if it does not freeze. Let us therefore say that the center of the world is in the frozen mud and will be in water and in earth together and [precisely] in the excess of cold and in a dark and motionless body that is contrary to the heavens.[117]

Tassoni reinforces this opinion by quoting from Plutarch's *De primo frigido*: 'the Earth, in its depths, is a certain matter congealed by cold and is ice, so to speak: for there pure cold unmitigated by any other quality is found, and [it is] very far from the ether'.[118]

Interesting too, is the reference to Dante's *La divina commedia*. Tassoni concentrates his attention on the last circle of the hell that Dante located at the centre of the universe; this circle is made of ice.[119] In light of Tassoni's reasoning, this reference now appears self-explanatory as providing further support for his own theory.

[116] Tassoni, *Pensieri*, IV, 14, p. 503.
[117] 'Io direi che come la superficie dell'una non avanza quella dell'altra, così il centro dell'universo non fosse più nell'una che nell'altra, ma fosse ugualmente in amendue, e in quella parte d'amendue che più nel freddo prevale. Il fango è un composto d'acqua e di terra; ma non è d'eccessivo freddo, se non si gela. Diciamo adunque che il centro del mondo sia nel fango gelato, e sarà nell'acqua e nella terra insieme e nell'eccesso del freddo e in corpo oscuro ed immobile e contrario al cielo', in Tassoni, *Pensieri*, IV, 14, p. 503.
[118] 'terra in profundo concretum aliquid frigore et, ut sic dicam, glacies est; frigus enim merum et nulla [qualitate] emollitum ibi habitat, longissimi ab aethere repulsum', in Tassoni, *Pensieri*, IV, 14, p. 503; Cf. Plutarch, *De primo frigido*, in Plutarch, *Plutarchi Chaeronensis moralia* (Basel: Thomas Guarinus, 1570), p. 542.
[119] See Dante Alighieri, *Inferno*, cantos 32–34.

In addition, it is intriguing to highlight the link between Tassoni, Plutarch, and Dante, which was the focus of a study published in 1905 by Giovanni Nascimbeni.[120] The juxtaposition of these three thinkers invites criticism with regard to Tassoni's use of well-known authors (Plutarch and Dante) as scientific sources. If, in relation to Plutarch, doubts can be raised about the inference of a frozen Earth at the centre of the world, rather than one comprised of some kind of stony matter,[121] even more questionable is Dante's thinking. Nascimbeni's study emphasises Dante's use of a poetical expedient to theorise the presence of a place made of ice, which coincides with the centre of the world. Dante obtained his conception of Cocito, where traitors are buried in ice, by assuming that the cold necessary to freeze the water was produced by the beating of Lucifer's wings; in other words, when Lucifer flaps his wings, an icy wind that freezes the water of the infernal river (Cocito) is produced. Therefore, ice being the centre of the universe was a coincidence that clearly missed any consideration of physical processes that would reflect a real conception of the world. Instead, Tassoni uses the presence of ice at the centre of the Earth, as claimed in Dante's *La divina commedia*, as a physical reason in support of his idea of the cosmos; without contextualising Dante's statement, Tassoni could use the poet as a source in support of his own idea, even though Dante was to a certain extent a supporter of the Aristotelian view. However, as far as my own study is concerned, Nascimbeni's contribution argues in favour of Tassoni's employment of sources to his own advantage to convey a precise cosmological theory, one that combines different ideas, and results in a new proposal containing a mix of tradition and

[120] G. Nascimbeni, 'Che cosa c'è al centro della terra secondo Plutarco, Dante e Alessandro Tassoni', in *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta*, ed. by Tommaso Casini and Venceslao Santi (Modena: A. F. Formiggini, 1908), pp. 249–65.

[121] According to Plutarch, being turned into stone is the last transformation a matter undergoes because of the excessive cold; therefore, as also pointed out by Nascimbeni (p. 254), by reading *De primo frigido* it could also be inferred that the coldest place will be made of stone rather than icy land. See Plutarch, *De primo frigido*, p. 543.

novelty that make it worthy of attention against the background of the philosophical doctrines in vogue at the time.

Coming back to the heart of the matter, according to Tassoni, the location of the centre of the universe in both earth and the water (IV, 12) is not because of the heaviness of these two elements, as Aristotle asserted, but to the necessity of distancing these cold and heavy bodies as far as possible from the hot, much lighter heavens. Naturally, the aim of creating this distance is to preserve these bodies from destruction. Indeed, Tassoni affirms that 'If opposites have to be preserved, they should be distant from each other so that one cannot destroy the other'.[122] This statement recalls an argument that is strictly Telesian: Telesio stressed the necessity of keeping the heavens and the Earth well apart because they had originated from the two fundamental, opposing principles of heat and cold that if close to each other, would destroy each other.[123]

Similarly, according to Tassoni, because the heavens, on the one hand, and earth and water, on the other, are complete opposites, they must be kept well apart from each other:

> And because the principle of cold and stillness concerns inseparably earth and water, as the opposite [the principle of heat] pertains to the heavens, it follows that earth and water always seek to keep themselves as far away from the heavens as they can in order to preserve themselves.[124]

However, the difference between Tassoni's and Telesio's thinking is also undeniable. Tassoni points out that both earth and water have characteristics completely opposite to those of the heavens. Both of them, according to Tassoni, are cold and do not move; in addition, they both exist in one single sphere that occupies the centre of the universe and contributes to the

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[122] 'Se i contrari hanno da conservarsi, conviene che siano l'uno dall'altro distanti in guisa che l'uno non possa distrugger l'altro', in Tassoni, *Pensieri*, IV, 12, p. 500.
[123] Cf. Telesio, DRN, II, 21, p. 120.
[124] 'E perchè nella terra e nell'acqua consiste inseparabilmente il principio del freddo e della quiete, come il contrario nel cielo, quindi è che la terra e l'acqua cercano sempre di mantenersi il più che possono lontane dal cielo per conservarsi', in Tassoni, *Pensieri*, IV, 12, p. 500.

creation and preservation of life.[125] Conversely, Telesio not only considered water to be warm, he even refused to include it among the primary elements necessary for the creation of life. Telesio fully rejected the Aristotelian theory with regard to the elements; according to him, nothing but matter and the two principles of cold and heat were necessary for the creation of every single thing.[126] This meant that water and air were not considered to be basic elements; in Telesio's natural philosophy, the Earth (cold) and the heavens (hot) were the only principal bodies:

> But, as it appears, the heavens and the Earth are not only the greatest bodies of the world, but also the first and principal ones […] In fact, the air, the sea, or all the waters, and all the other things that are between the heavens and the Earth, and those that are in the depths of the Earth, far from the nature of the Earth, appear to be continually changed and corrupted and generated both by the universe either the heavens from afar [or] especially the Sun, which is very intense, and also by the Earth itself; clearly, all things are produced by the Sun and the Earth, and that by the Sun and the Earth they [all things] are continually changed and transformed in their nature.[127]

Both Tassoni's adherence to naturalism, especially with regard to the use of cold and heat as the fundamental principles of the natural world, and his original delineation of the most representative theories of the Italian strand of thinking, are now acquiring a clearer definition. In addition, Tassoni's idea of the constitutive elements of the terrestrial reign is emerging. However, a comprehensive analysis must also pay attention to air and fire.

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[125] Tassoni, *Pensieri*, IV, 12, p. 500.
[126] Telesio, DRN, II, 16.
[127] 'At non magnae modo Mundi partes solum Coelum et Terra sola, sed primae etiam principesque videntur; […] aer vero et mare aquaeve omnes et caetera omnia quae in Coeli Terraeque medio sunt, et quae in profundioribus Terrae partibus a Terrae natura dimota assidue immutari corrumpique et assidue generari videntur, et ab universe utrumque Coelo a longe praesertim robustissimo effici Sole et a Terra etiam ipsa; a Sole nimirum e Terra fieri omnia et a Sole Terraque assidue immutari et in propriam agi naturam', in Telesio, I, 4, pp. 10–11.

Air and fire

It is unnecessary to say a great deal about air, but it is essential to include this element in order to achieve the correct, overall view of Tassoni's cosmos. According to Tassoni, air is located between the heavens and the Earth.[128] He emphasises that because of its characteristics, the air is the most balanced element: it is not inherently light or heavy, neither completely wet, nor hot or cold; rather, it is a semi-moist and tepid element that joins the heavens and the Earth, which are light/hot and heavy/cold, respectively. In support of his statement, Tassoni quotes Plutarch once again in order to stress that the air is a tepid element: 'the air, placed between water and fire, is neither hot nor cold, but mixed with a balanced combination drawn from the one extreme and the other'.[129] More precisely, according to Tassoni, the air is connected to the heavens because it is lukewarm and to the sphere of earth and water because it has a certain degree of wetness. It is, therefore, convenient for the overall cosmological order that the air should be located between the two elements with which it shares primary characteristics:

> All the mass comprised of earth and water is simply heavy; all the celestial mass is simply light. And they are opposites because one is motionless and the other is constantly restless; and the less dense part of the one [the mass comprised of earth and water], which is water is shiny, whereas the less dense part of the other [the celestial mass], which is ether is dark, and the density of the heavens is luminous and that of earth is dark and opaque; and the one [the celestial mass] is completely hot and the other [the mass comprised of earth and water] is completely cold. Between these two opposites and extremes, the semi-moist and tepid air is located, which by means of its tepidity is joined to the heavens and by means of its moisture is joined to water and to the surface of earth, which is also always mixed with moisture. But, by its nature, air is neither light nor heavy, nor completely moist nor hot; [...] And it is much better that what is neither light nor heavy, neither hot nor

[128] Following the analysis presented in the previous section, hereafter, the Earth should be considered as the terraqueous globe.
[129] 'Aër inter ignem et aquam interiectus neque calidus neque frigidus est, sed temperie ex utroque extremorum levi innoxiaque mixtus', in Tassoni, *Pensieri*, I, 1, p. 380.

> cold is between the light and the heavy, and the hot and the cold, than that one or the other dominate.[130]

Tassoni's reasoning so far depicts a cosmos that is still considered to be made up of two distinct regions: the celestial and terrestrial realms. However, the boundary between these realms is not as strongly marked as it was in the Aristotelian tradition. The air, which still belongs to the terrestrial realm, is not greatly different from the so-called ether, which, as we have seen in Tassoni's thinking, is a warm, air-like substance, purer and clearer than air, but with which the air itself is connected. Furthermore, Tassoni's terrestrial realm appears to be deprived of the element of fire, the element that, according to the traditional worldview, was situated in a sphere underneath the celestial realm and immediately above the sphere of air. A section of Aristotle's *Meteorologica* quoted by Tassoni has been used to narrow the distance between Tassoni's and Aristotle's ideas of the cosmos:

> We maintain that the celestial region as far down as the Moon is occupied by a body that is different from air and from fire, but which varies in purity and freedom from admixture, and is not uniform in quality, especially when it borders on the air and the terrestrial region. Now, as they move in a circle, this primary substance and the bodies embedded in it, set on fire and dissolve by their motion that part of the lower region which is closest to them and generates heat therein.[131]

According to Aristotle's argument here, the matter under the sphere of the Moon is not fire, but rather it is a kind of air warmed up by the motion of the heavens. Therefore, this matter must not be defined as fire.[132] Nonetheless, a more detailed analysis of Tassoni's lengthy

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[130] 'Tutta la massa della terra e dell'acqua è semplicemente grave; tutta la massa celeste è semplicemente leggiera. E sono opposte perché l'una è senza moto e l'altra è senza quiete; e'l raro dell'una, ch'è l'acqua è lucido e'l raro dell'altra, che è l'etere, è oscuro, e'l denso del cielo è luminoso e quello della terra è tenebroso ed opaco; e l'una è tutto calore e l'altra tutto gelo. Tra questi due contrari e estremi viene ad esser locata l'aria, semiumida e tepida, che mediante la tiepidezza si congiunge col cielo e mediante l'umidità si congiunge coll'acqua e con la superficie della terra, ch'è sempre anche'ella mischiata d'umido. Ma di sua natura non è l'aria né leggiera né grave né umida assolutamente né calda; […] E molto meglio conviene che quello che non è né leggiero né grave né caldo né freddo stia tra il leggiero e'l grave, e'l caldo e il freddo, che non che all'uno e all'altro sovrastia', in Tassoni, *Pensieri*, I, 1, p. 380.

[131] Aristotle, *Meteorologica*, I, 3, p. 19.

[132] Cf. Tassoni, *Pensieri*, I, 1, p. 381: 'Conchiudendo finalmente, che non si truovi fuoco elementale lo provo con la dottrina d'Aristotele medesimo, il quale nel 4. Capo del 1. Delle *Meteore*, ravviluppando ciò che di quello elemento avea detto altrove, *quod est sursum, ait, et usque ad lunam dicimus esse corpus alterum ab igne et ab*

discourse on elemental fire in *quesito* 1 of Book 1 of the *Pensieri diversi*, *Se ci sia l'elemento del fuoco* (Whether the elemental fire exists?) reveals how and why he rejects its existence.

In Italy, the argument against the existence of elemental fire was first and foremost disseminated by Cardano, and Tassoni's discussion of this topic owes much to Cardano's work. Indeed, in rejecting the existence of elemental fire, Tassoni mainly reports arguments already presented by Cardano against the supporters of the sphere of fire in Book 2 of his *De subtilitate*. These arguments are framed by Tassoni as a list of different reasons that would make the existence of elemental fire acceptable; all these reasons are then discussed with the aim of refuting them.

For the sake of clarity, whether discussed at great length or simply mentioned, Tassoni's arguments for rejecting fire as an element are organised here according to seven main topics:

- the basic characteristics of elements (note that this argument also includes a reflection on the role played by heat in the process of creation and the analogy between elemental fire and compound fire)[133]
- the theory of the elements as reciprocally transmutable
- the meteorological theory of comets
- the consideration of fire as a hot and wet element
- the theories of the humours

Tassoni points out that the existence of elemental fire was deduced by Aristotle from a discourse on the four basic characteristics of bodies. Having determined there are precisely four basic characteristics which are organised into two pairs of opposites (hot/cold and

aëre, quinimo et in ipso hoc quidem purius esse, illud autem minus sincerum et differentias habere et maxime qua desinit ad aërem et ad eum qui circa terram mundum. Cum autem fertur primum elementum circulo et corpora quae in ipso sunt, id quod propinquum est simper inferioris mundi et corporis motu disgregatum accenditur et facit caliditatem'.

133 The term 'compound fire' indicates that kind of compound body made principally of fire that we observe in the terrestrial region. Tassoni uses this expression to emphasise that fire must not be considered an element. More generally, therefore, when Tassoni mentions the fire (compound) it means what we would consider to be the flame.

wet/dry), Aristotle specifies that these characteristics can be combined in four different ways: hot–dry; hot–wet; cold–wet; cold–dry. These four combinations are considered to be properties of elemental bodies; consequently, the elements can only be four in number: earth, water, air, and fire. Specifically, fire must be the hot, dry element and, therefore, its existence is claimed to be necessary:

> the elementary qualities are four in number and of these four six couples can be formed; however, because things that are contrary to one another are not of a nature that permits them to be coupled—for the same thing cannot be hot and cold, or again, moist and dry—it is clear that the pairs of elementary qualities will be four in number, hot and dry, hot and moist, and, again, cold and moist, and cold and dry. And, according to theory, they have attached themselves to the apparently simple bodies, fire, air, water, and earth; for fire is hot and dry, air is hot and moist (e.g. air is vapour), water is cold and moist, and earth is cold and dry. Thus, the variations are reasonably distributed among the primary bodies, and the number of these is according to theory.[134]

However, we know that Tassoni considered the celestial bodies to be hot and dry. It is precisely because he stresses that the heavens possess those characteristics ascribed by Aristotle to elemental fire that Tassoni rejects the inference about the existence of elemental fire from the combination of the four characteristics. To put it another way, because of the duality of Tassoni's thinking – he considers the heavens to be hot and dry (as clearly evident by considering the heat emanated by the Sun which is the hottest celestial body) and the Earth cold and wet, he cannot support the existence of elemental fire since there is already a hot and dry body (the heavens and, more generally, the celestial bodies):

> And as far as the argument of the four combinations of the prime qualities is concerned, which seems the most powerful, my answer is that, no inconvenience follows from ascribing to the celestial bodies the fourth characteristic of hot and

[134] Aristotle, *On Coming-To-Be and Passing Away*, II, p. 275, in Aristotle, *On Sophistical Refutations*, *On Coming-To-Be and Passing Away*, *On the Cosmos*, trans. by E. S. Forster and D. J. Furley, Loeb Classical Library 400 (LCL) (Cambridge, MA: Harvard University Press, 1955).

> dry that Aristotle attributes to fire, as it is attested by sense that the sun is hot and dry.[135]

The hot and dry nature of the celestial realm entirely meets the criteria of and fulfils the tasks allotted to elemental fire, which, therefore, even if it existed, would be useless. This point is explained more fully by Tassoni when he addresses the creation of mixed bodies, a topic which provides further proof that elemental fire does not exist. Greek philosophers, such as Heraclitus, had believed that elemental fire, which was preserved in the alleged sphere of fire, was also the origin of the heat necessary for the creation of animals or, more generally, of mixed bodies.[136] In contrast, by relying on Cardano's conception of celestial heat,[137] Tassoni emphasises the role played by the Sun in accomplishing the task of creation. Most obviously, creation cannot be caused by elemental fire because some bodies are created at the bottom of the sea or in the bowels of the Earth:

> Mixed bodies, besides, that are generated at the bottom of the sea and in the bowels of the Earth, such as rubies, diamonds, pearls, corals, sulfur and gold mines, are considered to be produced by virtue of the sun because fire could not descend to those parts with violent motion, contrary to its nature explained with such respected reasons. Therefore, why introduce fire if the sun can do more than fire for the same effects?[138]

Because these bodies are far from the sphere of fire, elemental fire cannot contribute to their creation. Rather, Tassoni claims, celestial heat is involved in the process of creating both

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[135] 'E quanto all'argomento delle quattro combinazioni delle prime qualità, che pare il più possente, rispondesi che, trasportando ai corpi celesti quella quarta di caldo e secco che Aristotele attribuisce al fuoco, non ne seguita inconveniente alcuno poi che in ogni modo si tocca col senso che il sole ha virtù calda e secca', in Tassoni, *Pensieri*, I, 1, p. 377.

[136] In other words, it was believed that because the compound fire had its beginnings in the sphere of fire (the elemental fire), it moved spontaneously upward to join this.

[137] Cardano equates celestial heat with the soul itself. Celestial heat is the basis of worldwide creation, and the hot and the wet are the only two primary characteristics of the body; they also characterise the celestial realm. Conversely, all the elements are cold in themselves. These themes can be found in Book 2 of *De subtilitate*. For a general overview of Cardano's natural philosophy, see Alfonso Ingegno, *Saggio sulla filosofia di Cardano* (Florence: La nuova Italia, 1980).

[138] 'I misti, oltre a ciò, che si generano nel fondo del mare e nelle viscere della terra: rubini, diamanti, perle, coralli, miniere di zolfo e d'oro, diciamo che sono prodotti dalla virtù del sole perchè non potrebbe il fuoco con moto violento e contra natura da ragioni sì alte discendere a quelle parti. Adunque a che introdurre il fuoco, se per gli stessi effetti il sole può più di lui?', in Tassoni, *Pensieri*, I, 1, p. 375.

living and sterile bodies. By referring to Book 2, Chapter 3 of Aristotle's *Generation of Animal*s, Tassoni maintains that even animals' genital heat is a *virtus* imparted by the Sun; thus, their genital heat is derived from celestial heat:

> In all cases the semen contains within itself that which causes it to be fertile—what is known as the 'hot' substance, which is not fire or any similar substance, but the pneuma that is enclosed within the semen or foam-like stuff, and the natural substance that is in the pneuma; and this substance is analogous to the element that belongs to the stars. That is why fire does not create any animal, and we find no animal taking shape either in fluid or solid substances while they are under the influence of fire; whereas the heat of the Sun does effect creation, and so does the heat of animals, and not only the heat of animals which operates through the semen, but also any other natural residue there may be that has within it a principle of life. Considerations of this sort show us that the heat in animals is not fire and does not originate or obtain its principles from fire (*Generation of Animals*, II, p. 171–72).[139]

Consequently, if fire existed as an element, it would have no role to play in creation.[140]

Tassoni provided more examples to argue that both because of its location and its motion, elemental fire could not contribute to the creation of inferior bodies and their mixed composition of heat and cold.[141] As far as the location of elemental fire is concerned, if we assume that elemental fire is situated under the sphere of the Moon, it cannot have a direct effect on creation because it is so far from earth and water and is separated from them by air. At this distance, elemental fire cannot combine with the mass of earth and water as is necessary

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[139] Aristotle, *Generation of Animals*, II, p. 171–72. Cf. Tassoni, *Pensieri*, I, 1, p. 381.

[140] The theme of creation and, thus, of the involvement of the Sun in this process, is widely discussed in *quesito* 10 of Book 3 of the *Pensieri diversi*: *Come s'intenda quella proposizione: sol et homo generant hominem* (What is the meaning of the proposition: sun and man generate everything that lives), in Tassoni, *Pensieri*, pp. 458–71 (III, 10). I will not deal with this topic as such; however, I provide an excerpt here that supports what I have just pointed out: 'It is clear that the natural heat that is felt and seen in all animals is nothing other than an infused virtue of the Sun, the celestial principle of heat, life and light, which eternally moves around. And therefore, the ancients well said *quod sol et homo generant hominem*, because no generation at all can take place either of man, or of any other kind of animal without this virtue of the Sun (chiara cosa è che'l calor naturale che in tutti gli animali si sente e si vede non è altro che una infusa virtù del sole, celeste principio di calore e di vita e di luce, ch'eternamente si muove in giro. E però ottimamente dagli antichi fu detto quod *sol et homo generant hominem*, perché non si fa generazione alcuna senza né d'uomo né d'altra sorte animale senza questa virtù del sole)', in Tassoni, *Pensieri*, III, 10, p. 461.

[141] Tassoni, *Pensieri*, I, 1, p. 377.

for creation. Likewise, according to Tassoni, elemental fire also cannot contribute to creation via *virtus* since it does not appear to be able to impart its heat through the air, as does the Sun; the air is not hotter in the upper regions, as would be expected if it were affected by the hot and dry sphere of fire. Secondly, to stress further that elemental fire would have no role in the process of creation, Tassoni mentions compound fire, which was considered by the Aristotelians as proof that elemental fire existed in an alleged sphere surrounding the other elements. They argued that because compound fire had its origins in the sphere of fire (that is, in elemental fire), it moved spontaneously upward to join the sphere of fire. In contrast, Tassoni stressed that the tendency of compound fire to move upward, thus distancing itself from the inferior bodies, proves its lack of involvement in helping to create bodies. In addition, having affirmed that the principle of heat pertains to the heavens, in great part to the Sun, Tassoni also explains that the upward and pyramidal motion of the fire observed in our daily experience (e.g., flames licking upward) does not require inferring a sphere of fire (towards which fire moves spontaneously) in the upper realms of the terrestrial realm:

> And herewith also is disproved the argument of fire going upward because, having its beginning in the heavens, it moves spontaneously to that side; and it moves in a pyramidal form in order to ascend more quickly, that form being more suitable for cleaving and penetrating the body of air, and because it moves perhaps even to the point of that star which is still perpendicular to it. For if it [the fire] tried to unite with the sphere of fire surrounding the air, it would not shrink into an acute pyramid; on the contrary, it would broaden on the upper side in order to unite better with the sphere where it began.[142]

Tassoni maintains that if the sphere of fire existed, it would be more appropriate to suppose it had a different kind of motion; more precisely, if the fire existed as an alleged sphere

[142] 'E con questo cessa eziandio l'argomento del fuoco che va allo'nsù perchè, avendo egli il suo principio nel cielo, si muove spontaneamente a quella parte; e si muove in piramide per più tosto salire, essendo quella figura più atta a fendere e penetrare il corpo dell'aria, e perchè si muove forse anco al punto di quella stella che più gli si trova perpendicolare. Ché se egli cercasse di unirsi alla sfera del fuoco sparsa dintorno all'aria, non si restrignerebbe in piramide acuta; anzi s'allargherebbe dalla parte di sopra per unirsi meglio alla sfera del suo principio', in Tassoni, *Pensieri*, I, 1, p. 378.

surrounding the other elements, it would grow bigger rather than smaller (as happens in its pyramidal form). However, fire is considered to be just an *accidens* due to excessive heat. It is attracted to further heat and, therefore, it simply moves in the most efficient way towards the hot heavens:

> the principle that moves things upward is not elemental fire, which does not exist, nor composed fire nor smoke nor flame; but heat, which, being a celestial thing that participates in things here below, where it is repelled by its opposite, which is cold, and it is attracted to its beginning, which is in the heavens. This has primarily the virtue of raising the flame, that is, of all composed things, the hottest and lightest and most similar to the sun and the stars, and after it all those types of matter which are apt to be kindled and converted into flame, such as fumes, flares, saltpetre, smoke and other such things which are lifted up by virtue of heat and flame. And we also walk raised upward toward the heavens because our upper parts are warmer than those of the other land animals.[143]

The distinction between elemental fire and compound fire in the terrestrial region provides more evidence for refuting the argument that fire is an element which contributes to creating the cosmos. It is clearly evident, according to Tassoni, that compound fire is hot and capable of burning things and that it cannot exist without the kind of matter that fuels it; in fact, it ceases precisely at the point at which it is deprived of the substance that causes it to burn. In his view, everything that needs something else to exist cannot be a basic element.[144] If elemental fire existed, compound fire should have derived its characteristics from elemental fire. Indeed, it is not logical to suppose that elemental fire would be able to pass on these characteristics without itself possessing them. However, if elemental fire existed, and had the

[143] 'il principio che muove le cose allo 'nsù non è il fuoco elementale, che non si truova, né questo nostro fuoco composto né il fumo né la fiamma; ma il calore, il quale essendo cosa celeste partecipata alle cose di quaggiù, quindi è che cacciato dal suo contrario, che è il freddo, e tirato dal suo principio, che è in cielo, ha virtù di sollevare principalmente la fiamma, come più calda e leggiera e più simile al sole ed alle stelle di tutte le cose composte, e dopo lei tutte quelle materie che sono atte ad accendersi e convertirsi in fiamma, come l'esalazioni, i razzi, il salnitro, il fumo ed altre tali che si sollevano con la virtù del calore e della fiamma. E noi pure camminamo sollevati verso il cielo per aver più calde le parti superiori degli altri animali terrestri.', in Tassoni, *Pensieri*, I, 2, pp. 384–85.

[144] Indeed, compound fire is considered by Tassoni to be nothing but matter that has been ignited, as explained in *quesito* 2 of Book 1 of the *Pensieri diversi*, *Se 'l fuoco composto si muova allo 'nsù* (Whether the compound fire moves upward). This covers the theme of the compound fire and its motion. For more details on the topic, see Tassoni, *Pensieri*, I, 2, pp. 383–85.

characteristics ascribed to compound fire, it could warm the air to a point at which animals would be prevented from breathing. The existence of living beings clearly attests that this does not happen; therefore, elemental fire cannot exist.[145]

The arguments presented by Tassoni serve also to further disprove the conception of the heavens held by Aristotle, who denied that the celestial bodies were inherently hot. According to Aristotle, heat is not a characteristic inherent to the heavens; rather it results from motion.[146] More precisely, heat is caused by the friction in the air produced by the motion of celestial bodies.[147] However, Tassoni highlights a contradiction found in Aristotle's *Meteorologica*, Book 2, Chapter 8: in the context of a discussion about earthquakes, Aristotle seems to suggest the contrary. Namely, Tassoni points out that Aristotle himself, speaking about the Sun, suggests it must be inherently hot.[148] In particular, Tassoni refers to the earthquakes that Aristotle said could coincide with lunar eclipses:

> an earthquake sometimes occurs at an eclipse of the Moon. For when the interposition is approaching but the light and warmth from the Sun, though already fading, have not entirely disappeared from the air, a calm falls when the wind runs back into the Earth. And this causes the earthquake before the eclipse.[149]

According to Aristotelian thinking, earthquakes were caused by wind that had become trapped in the Earth (dry exhalation; *pneuma*). During a lunar eclipse, Aristotle explained, it would be impossible for the Sun to impart its heat and light to the Moon, which was in the shadow of the Earth. In turn, the Moon could not transmit its warmth to the air that was contiguous with the Earth; as a consequence, this air cooled down, and no wind was produced;

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[145] Tassoni, *Pensieri*, I, 1, p. 382.
[146] Aristotle, *Meteorologica*, I, p. 19.
[147] This topic was also rejected by Telesio, Giacomo Antonio Marta, and Campanella, see Bondì, *Il primo dei moderni*, pp. 87–96.
[148] Tassoni, *Pensieri*, I, 1, p. 378.
[149] Aristotle, *Meteorologica*, II, 8, p. 215.

thus, the *pneuma* that should have risen from the Earth was trapped, causing an earthquake. In Tassoni's words:

> Nor did the same Aristotle, who was so intent on denying the heat of the sun, seem to know how to conceal it in the eighth chapter of Book 2 of Meteore, where, searching for the reason why earthquakes occurred during the eclipse of the moon, he said that at that time the moon, deprived of the heat and light of the sun, could not communicate it [the heat] to the air, so that the region adjacent to the earth cooled down and the 'breath' that came out of the Earth returned to be intensified and enclosed in it and, thus enclosed, destroyed and shook it. Therefore, if the moon receives heat from the sun, this cannot be attributed to the crushing of the air, and it must be admitted that it is warm.[150]

According to Tassoni, if Aristotle accepts that the Sun imparts heat to the Moon, Aristotle himself should have believed that the Sun was inherently hot. In fact, Tassoni considers it impossible that the Sun can transmit heat to a body far away from it simply by means of its motion. The very same argument and reference to Aristotle's *Meteorologica* is found in Telesio's *De rerum natura*, Book 2, Chapter 46, in which the theme of the heat and light of the Sun is discussed.[151]

Tassoni's focus on heat as a characteristic pertaining both to the Sun and fire leads him to reject the difference between celestial heat, considered to be incorruptible, and the heat of the fire, considered to be corruptible, that had been introduced by those who supported the existence of elemental fire. Tassoni's argument for rejecting this theory, which is based on the existence of two *species* of heat, refers to Alexander of Aphrodisias's discourse on the primary

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[150] 'Né l'istesso Aristotile, così intendo a negare il calor del sole, parve che nell'ottavo capo del 2. delle *Meteore* lo sapesse occultare, ove, ricercando perché nell'eclissi della luna si generassero tremuoti, disse che allora la luna, privata del calor del sole come del lume, non lo poteva comunicare all'aria, onde la regione contigua alla terra si raffreddava e lo spirito che usciva della terra tornava a concentrarsi e chiudersi in essa e, chiuso, la crollava e scoteva. Adunque, se la luna riceve calor dal sole, ciò allo stritolamento dell'aria non si può attribuire e bisogna confessare ch'egli sia caldo', in Tassoni, *Pensieri*, I, 1, p. 378.

[151] The difference between Aristotle's and Tassoni's thinking with regard to the celestial heat has already been discussed, and the similarity between Tassoni and Telesio has been emphasised. In general, Telesio's reasoning is in contrast to the Aristotelian theory according to which heat is produced by the motion of the Sun and, consequently, by the friction in the air produced by the heavenly motion. A timely comparison between Tassoni's *quesito* on the elemental fire (especially the arguments found on pp. 377–82) and Telesio's texts further reveals the influence of Telesio on Tassoni's arguments. With regard to this topic, I would suggest looking especially at Telesio's texts in DRN, II, 40–50, pp. 353–405.

characteristics of bodies (*virtus* or *potestas*): these characteristics are eternal and are according to that which creates their form (heat for the celestial region and cold for the terrestrial region). Following Plato's arguments, Tassoni affirms that if elemental fire existed in our realm, its heat would be eternal because corruptibility is due to matter and not to the characteristic of heat itself. Similarly, the distinction between the heat of the heavens and the heat of elemental fire was asserted on the basis of the ability of the heat of the heavens to give life and of the heat of elemental fire to be destructive. Tassoni rejects this argument by pointing out that even celestial heat, if excessive, is able to wreak destruction; therefore, the existence of different kinds of heat must be rejected along with the existence of elemental fire.[152]

Furthermore, as far as the capacity of both the Sun and elemental fire to warm things up is concerned, Tassoni wonders why we can feel the heat of the Sun, whereas we cannot feel the heat of elemental fire, which is supposed to be even closer to us than the Sun. In addition, we can feel the characteristics ascribed to the other three elements: the moistness of air, the coldness of water, and the dryness of earth.[153] This argument, therefore, is further proof that elemental fire does not exist: if it existed, we should be able to feel it.

Another argument derived from Aristotle also infers the existence of the fire by reasoning according to two opposite characteristics of the elements: this time, heaviness and lightness. Tassoni writes:

> Let "the heavy" then be that whose nature it is to move towards the centre, "the light" that whose nature it is to move away from the centre, "heaviest" that which sinks below all other bodies whose motion is downward, and "lightest" that which rises to the top of the bodies whose motion is upward. Thus, each body that moves downward or upward must have either lightness or weight or both. A body cannot of course be both heavy and light in relation to the same thing, but the elements are

[152] For example, Tassoni asserts that during the summer, the Sun (celestial heat) dries out the plants; conversely, the heat of the fire can contribute towards supporting life when it is not too hot, as is evident by considering that it supports the birth of chicks in Egypt or the birth of the silkworm in Italy. Tassoni, *Pensieri*, I, 1, pp. 382–82).
[153] Tassoni, *Pensieri*, I, 1, pp. 376.

> so in relation to each other, for example, air is light in comparison with water, but water in comparison with earth.[154]

Heaviness and lightness can pertain to different elements both absolutely and relatively: that is, earth is heavy (absolutely), and both air and water are light to some degree but also heavy to some degree. Therefore, in requiring an element at the other end of the scale from earth (that is, an element was light absolutely), Aristotle claimed this was fire.[155] Tassoni again concentrates on the difference between the heavens and the Earth and, thereby, creates a spectrum of lightness and heaviness; the heavens are light and hot, and the mass of earth and water is heavy and cold. Therefore, no other absolutely light element is necessary. It should be remembered that when Tassoni refers to those things that can be considered heavy or light not absolutely but only relatively, he is referring to mixed bodies rather than basic and simple elements. Mixed bodies, indeed, are heavy or light according to the extent to which they consist more of one characteristic (hot or cold) than another. The examples mentioned by Tassoni here are the swallow and the ox, these being bodies that are light and heavy respectively.[156]

Moreover, Tassoni emphasises that if according to Aristotle the heavens are made up of the weightless and incorruptible fifth element called ether, whereas fire is a light element which has a tendency to rise, the location of fire below the heavens (and the very existence of fire) should be rejected: 'for if it were true that heavens were not light and fire was, then fire would undoubtedly be above the heavens'.[157] A light body should, in fact, be on top of a body that is weightless, and this is how Aristotle conceived the heavens. Once again, Tassoni's reasoning

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[154] Aristotle, *On the Heavens*, I, 3, pp. 19–21.
[155] Cf. Emma Gannagé, 'Alexandre d'Aphrodise In de generatione et corruptione apud Gabir b. Hayyan K. al Tasrif', *Documenti e studi sulla tradizione filosofica medievale*, 9 (1998), 35–86; E. Gannagé, 'Matière et élements dans le commentaire d'Alexandre d'Aphrodisie In De generatione et corruptione', in *Aristotele e Alessandro di Afrodisia nella tradizione araba. Atti del colloquio La ricezione araba ed ebraica della filosofia e della scienza greche. Padova, 14–15 maggio 1999*, ed. by Cristina D'Ancona and Giuseppe Serra (Padua: Il poligrafo, 2002), pp. 133–49.
[156] Tassoni, *Pensieri*, I, 1, p. 380.
[157] 'Ché se fosse vero che il cielo non fosse leggiero e il fuoco sì, il fuoco senza dubbio starebbe sopra al cielo', in Tassoni, *Pensieri*, I, 1, p. 380.

with regard to the primary characteristics of the elements supports the rejection of elemental fire.

The basic characteristics of the elements gave Tassoni extensive material to his rejection of the existence of elemental fire. However, he also touched upon the theory of the elements being reciprocally transmutable and the meteorological theory of comets to reinforce his arguments.

The theory of the elements being reciprocally transmutable is found in Aristotle's *On Coming to Be and Passing Away*, Book 2, Chapter 4. Tassoni argues that if fire existed as an element it would be possible to apply to it a contrary quality without it losing its own form. Indeed, as Tassoni sees it, transmutability occurs among the other three elements: air can be cooled down and both earth and water can be heated up. None of these elements loses its form as its temperature thus changes. However, with regard to fire, Tassoni believes that such a change is not possible. Therefore, the question to be considered is why all the elements except for fire can combine with each other.[158] Tassoni declares that the answer is very easy: because fire is not an element, just an excess of heat, it loses its form when the excess vanishes and it cools down. His argument also applies to ice, which is just an excess of cold and, consequently, loses its form when it is heated up.

Aristotle's theory of comets can be found in his *Meteorologica*. Within the Aristotelian framework, comets and other bodies that were apparently on fire were taken as further evidence of the existence of elemental fire; these phenomena were supposed to occur because of a fiery matter igniting terrestrial vapours. However, in Section 4.2 of this chapter, we have already

[158] The topic of the non-transmutability of fire is also taken into consideration in *quesito* 9 of Book 1 of the *Pensieri Diversi*, *Perché l'acqua e la terra si possono riscaldare e l'aria raffreddare, rimanendo aria, acqua e terra; e il fuoco non si possa raffreddare senza perdere la forma di fuoco* (Why water and earth can be heated up and the air can be cooled down while remaining air, water, and earth, whereas the fire cannot be cooled down without losing its own form), Tassoni, *Pensieri*, pp. 396–97.

seen that Tassoni denied comets were composed of fiery matter; therefore, the existence of the sphere of fire based on this argument can be refuted.[159]

Within Tassoni's *quesito*, the reasons for refuting the existence of elemental fire seem to be much more persuasive than the theories support it. We have seen Tassoni blending a large variety of themes, from the characteristics of the basic elements and the argument for their transmutability to the characteristics of compound fire and the process of creation. All of these themes disprove the existence of elemental fire. By analysing Aristotle's *On Coming to Be and Passing Away* and *On the Soul*, Tassoni points out that, according to Aristotle, elemental fire is a homogenous, dry, and bright matter; however, if this were true, it should be dense and visible like the stars. By then mentioning Cardano, Tassoni emphasises that, on the contrary, common sense attests that we cannot see the sphere of fire;[160] therefore, it seems appropriate to deny that elemental fire exists; in fact, 'with the eye, one sees clearly that from the Earth to the place of the moon there is nothing but air. Therefore, it is vanity to fantasise with the intellect that there is fire'.[161]

The location of the sphere of fire is further questioned by focusing on the characteristics attributed by Aristotle to fire and air, which are contiguous elements. The air was deemed to be hot and wet, whereas fire was considered to be hot and dry; now, considering that Aristotle believes that heat separates the non-homogeneous things and coalesces the homogenous things, Tassoni explains:

> for 'hot' is that which associates things of the same kind (for to 'dissociate', which, they say, is an action of Fire, is to associate things of the same class, because the result is to destroy things which are foreign), but cold is that which brings together

[159] In addition to the more extended arguments listed above, Tassoni also refers, although only briefly, to a link between the alchemical theory of the humours and the existence of elemental fire. This link is the argument that the red humour, which prevails in a body, would suggest the presence of elemental fire. The medical theory of health as a balance between opposing elements is ascribed to Alcmeon by the Greek doxographer Aetius. See H. Diels and W. Kranz, *I presocratici*. Testo greco a fronte, ed. by Giovanni Reale (Milan: Bompiani, 2006).
[160] Tassoni, *Pensieri*, I, 1, p. 374.
[161] 'Coll'occhio si vede chiaro che da terra al luogo della luna non v'è altro che aria. Adunque è vanità l'andar con l'intelletto fantasticando che vi sia fuoco', in Tassoni, *Pensieri*, I, 1, p. 374.

> and associates alike both things that are of the same kind and things that are not of the same class. Moist is that which, though easily adaptable to form, cannot be confined within limits of its own, whereas dry is that which is easily confined within its own limits but is not easily adaptable in form.[162]

Moreover, since Aristotle maintains that moist things tend to spread, Tassoni then points out that if fire is hot and dry, it cannot expand more than the moist, cold air:

> But even if heat expands fire, I say that in any case only the dry, which is a quality that shrinks things, would suffice to prevent fire from expanding more than air because it has one and the other of its first qualities that diffuse it; we say either that it [air] is uniform, as it really is by nature, or mixed with fumes and vapours, as it is down here.[163]

In other words, Tassoni is further criticising the alleged location of the elemental fire in a sphere that surrounds the air. This reasoning leads Tassoni to discuss the argument according to which elemental fire should be considered wet rather than dry. Indeed, the supposed invisibility of elemental fire, grounded in its tenuity, could be justified only by attributing the quality of being wet to this element, an idea developed by Telesio. It is no coincidence that the same references from Aristotle's *On Coming to Be and Passing Away*, Book 2, Chapters 8–10 used by Tassoni are found in Book 2, Chapter 25 of *De rerum natura*; most probably, Tassoni had Telesio's discourse in mind.[164] In particular, to explain why fire should be considered wet rather than dry it is necessary to focus on the following Aristotelian reasoning about wet and dry:

> From the moist and the dry are derived the fine and the coarse, the viscous and the brittle, the hard and the soft and the other contrasted pairs […] it is clear that the fine is derived from the moist and the coarse derived from the dry. Again, the viscous is derived from the moist (for that which is viscous is moisture that has undergone a certain treatment, as in the case of oil), and the brittle is derived from

[162] Aristotle, *On Coming to Be and Passing Away*, II, p. 271.
[163] 'Ma dato eziandio che il calore dilatasse il fuoco dico che in ogni modo il secco solo, qualità ristrignente basterebbe a non lasciar dilatare il fuoco più dell'aria, la quale a[vendo] l'una e l'altra delle sue prime qualità che la diffondono, diciamo o che sia uniforme, com'è veramente di sua natura, o misturata d'esalazioni e vapori, com'è quaggiù', in Tassoni, *Pensieri*, I, 1, p. 374.
[164] Cf. Telesio, *De rerum natura*, II, 25, pp. 284–92.

> the dry; for the completely dry is brittle, so that it has become solid through lack of moisture. Further, the soft is derived from the moist (for the soft is that which gives way and sinks into itself but does not change its position, as does the moist; hence, too, the moist is not soft, but the soft is derived from the moist). The hard, on the other hand, is derived from the dry; for that which has solidified is hard, and the solid is dry.[165]

Considering this excerpt and the previous one, we know that according to Aristotle, wetness is a characteristic that can easily spread; its properties are thinness and softness. On the contrary, dryness is a characteristic that does not spread easily; dry things are compact (*corposità*) and hard. Now, because Aristotle's followers considered the fire to be thinly spread, liquid, pure and, consequently, invisible, Tassoni, in agreement with Telesio, emphasises that these characteristics belong to wet elements rather than dry ones: 'Then, according to the doctrine of Aristotle himself, if we introduce an invisible element of fire, it would be more appropriate to say that it was wet and hot and not hot and dry'.[166]

Assuming elemental fire to be hot and wet would also be in agreement with the Aristotelian idea that it is opposed to earth with respect to their locations; however, this is not tenable from the point of view of motion. Earth is the immovable element; therefore, the fire cannot be contrary to earth because, otherwise, it would have been assumed by Aristotle himself that fire moved with an inherent, perpetual motion per se rather than being forced to move by the motion of the Moon's sphere. Moreover, if fire were considered wet rather than dry, it would appear necessary to revise the whole Aristotelian theory of the elements; because this theory is based upon the relationship between pairs of opposites, it would be significantly undermined with the assumption of three wet elements—water, air, *and* fire. Consequently, even if Aristotle had attributed different characteristics to fire, his theory of the elements would be untenable. By means of this theoretical reasoning, in line with contemporaneous sources

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[165] Aristotle, *On Coming to Be and Passing Away*, II, pp. 271–73.
[166] 'Adunque, secondo la dottrina d'Aristotele stesso, se introduciamo un elemento di fuoco invisibile, converrà dire che gli sia umido e caldo e non caldo e secco', in Tassoni, *Pensieri*, I, 1, pp. 374–75.

(especially Cardano and Telesio), Tassoni demonstrated that it was not possible to include fire among the elements and that its acceptance as an element created flaws within the Aristotelian system of natural philosophy.

Concluding remarks about Tassoni's idea of the terrestrial region

Tassoni's theory of the elements, which excludes the existence of the sphere of fire and unifies earth and water in a unique sphere, corroborates the interpretation that he distances himself from the traditional view of the universe. His cosmos still preserves the idea of the necessity of an interaction between bodies that are opposed to one another, which is aimed at the preservation of the universe, and this contrariety is found between the mass that is comprised of water and earth, and the celestial mass, which are complete opposites, as their characteristics attest. The air, which is the in-between element, marks the border between the terrestrial and celestial regions, and according to Tassoni is an air-like substance that he continues to call the 'ether', harking back to antiquity.

In light of the above, the analysis of Tassoni's use of sources traditionally associated with the Aristotelian–Scholastic view of the cosmos reveals that they were deployed in support of a new understanding of nature that was in line with both some of the philosophical tenets of the Italian 'naturalist' school and the interpretation of the recent astronomical discoveries by other *novatores*. However, despite his innovative views, Tassoni's understanding of the cosmos does not include a rethinking of the Earth's position and its motion. Tassoni remains on the traditional side of the geocentric–heliocentric debate, and the theories hitherto discussed already suggest that he supported the geocentric *systema mundi*. The natural principles at the basis of Tassoni's cosmological theory argue in favour of a universe in which the immobility of the Earth is irrevocable, because the Earth is inherently cold, and the most significant feature of coldness is immobility. The way in which Tassoni refutes heliocentrism will be considered in Chapter 5.

4.4 On the extension of the cosmos

The multiplicity of the heavens and the infinity of the universe

In shaping his conception of the cosmos, Tassoni also hints at two topics worthy of consideration for the role they play in the characterisation of early modern science: the number of the heavens and the dimensions of the universe. Tassoni's reflections on the composition of the universe led him to embrace some of the most recent theories of his time that had emerged following the new discoveries of the late sixteenth century, in particular, the idea of the sphere-less heavens. Tassoni's idea about the multiplicity of the heavens is set within the context of this break with tradition. Those theories that diverged from long-held tradition were viewed with suspicion, and because of this, Tassoni's presentation includes expedients to avoid theological censorship. Tassoni's specification that his rejection of the hard spheres did not imply that he denied the multiplicity of the heavens may be included among these:

> It may well seem to someone that I have denied the multiplicity of the heavens, contrary to the testimony of the Sacred Scriptures; but I do not say for this reason that, in addition to that of the *primum mobile*, there are not the crystalline, the empyrean and any others [heavenly spaces] supported by the reverend theologians.[167]

The debates about the number of spheres had started in antiquity. In the early seventeenth century, most astronomers and natural philosophers replaced the Ptolemaic model of nine spheres with a theory in support of ten. In this version of the geocentric world system, the ninth sphere was called the *primum mobile* and was conceived of as starless. It was subject to

[167] 'Ben potrebbe parer ad alcuno che io avessi negata la multiplicità de' cieli, contra il testimonio delle Sacre Lettere; ma io non dico per questo che, oltre quello del primo mobile, non vi siano il cristallino, l'empireo e se altri ne pongono i reverendi teologi', in Tassoni, *Pensieri*, II, 3, p. 417.

different interpretations and, eventually, came to be linked with an entity made of congealed waters of biblical origin: the crystalline sphere.[168] Theologians also introduced the concept of the Empyrean heaven (highest heaven), which encompassed the world. From the twelfth century onwards, it had been considered as the final—and immobile—sphere, the one identified with the heaven created by God on the first day of the Creation and described in the Book of Genesis.[169]

The evolution of theories concerning the number of spheres was complex and, naturally, the topic was particularly significant for those who believed in the physical existence of the spheres. It has been said that Tassoni was not among these because he rejected the idea of the heavens being divided into real spheres; however, this line of thinking still did not seem to erase his notion that there was some sort of boundary between the different areas of the physical world:

> It should not seem strange that the ethereal space borders on the heavens, that is of the primum mobile, and that it is not visible like the stars, because such a multitude of splendours can obscure sight, so that our eye cannot penetrate further into that immense distance and be able to see a body less bright than the stars and more distant than they are.[170]

In Tassoni's view, the cosmos should be configured as a geocentric system comprised of the mass of earth and water, the air, the ether—including the firmament—and the *primum mobile*, even if this latter, as well as the space beyond, is difficult for humankind to comprehend. It is clear, therefore, that the theme of the multiplicity of the heavens was considered by Tassoni to be outside the domain of natural principles; consequently, he did not

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[168] See Grant, *Planets, Stars, and Orbs*, pp. 308–15.

[169] However, the theological acceptance of an immobile sphere contrasted with Aristotelian cosmology, which stated that every natural body is endowed with motion. For an account of the debates about the empyrean heaven, see Grant, *Planets, Stars, and Orbs*, pp. 371–89.

[170] 'Né paia strano che'l vano dell'etere confini col cielo detto del primo mobile e ch'ei non si vegga come le stelle poi che tanta moltitudine di splendori ne può offuscar la vista, sì che l'occhio nostro in quella immensa distanza non possa penetrar più oltre ed arrivare a vedere un corpo men lucido delle stelle e più distante di loro', in Tassoni, *Pensieri*, II, 4, p. 418.

provide a detailed account of this topic. Nonetheless, this makes his brief statement on the multiplicity of the heavens even more significant because it is representative of Tassoni's cautious attitude when dealing with topics at the boundaries of science and religion. In fact, Tassoni's focus on scientific questions is based on a different perspective with respect to the domain of the religious authorities. It would normally have been the case that the two different approaches of 'science' and religion must not overlap, although Tassoni would seem to suggest they can coexist. However, because he sits on the side of the natural philosophers, everything outside of the domain of natural philosophy is excluded from his focus.

Of a similar mind, but critical rather than cautious with regard to the theologians, Francesco Patrizi maintained that philosophers and astronomers had every right to talk about the number and shape of the heavens, claiming that the Scriptures did not include any clear statement on this matter.[171] Patrizi also complained about the support astronomers gave to the Aristotelian way of thinking, at the expense of a realistic vision of the cosmos. Among the things he disagreed with was the reality of the spheres, which as we have already seen, he opposed, in contrast to Telesian philosophy.[172] Most importantly, Patrizi not only rejected the division of the heavens into real spheres, he even came to the point of denying the sphericity itself of the heavens, and also favoured the idea of the infinity of the cosmos.[173]

Interestingly, the infinity of the universe was envisaged by Tassoni too. Again, there is no specific *quesito* devoted to the nature of the ninth sphere (*primum mobile*) and the infinity of the universe; however, when Tassoni refers to the *primum mobile*, claiming its immobility, he also suggests a tentative commitment to an 'open' universe devoid of boundaries:

> If, then, the heaven called the *primum mobile* moves, I think it does not. Also, I maintain that the last heaven is not finite, in contrast to the Peripatetics, because, if

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[171] Patrizi, *Pancosmia*, XI, 84 r–86 r.
[172] Cf. Chapter 3, Section 3.4.
[173] See Cesare Vasoli, 'Francesco Patrizi sull'infinità dell'universo', in *Filosofia e cultura. Per Eugenio Garin*, vol. 1 of 2 vol., ed. by Michele Ciliberto and Cesare Vasoli, (Rome: Editori Riuniti, 1991), pp. 276–308.

> it were finite, it would be surrounded by nothing, against which [is the fact] that it is not possible to imagine "as something is contained by nothing", and if it moved, it would still move within nothing, with the same drawback.[174]

Tassoni's hypothesis on the immobility and infinity of the *primum mobile* appears to be grounded in the impossibility that it is surrounded by nothing (*nihil*). However, any definite theory on the topic is missing. The infinity of the universe can be included among the themes that caused the works of Tassoni's predecessors and contemporaries to be condemned, and Tassoni's own analysis of these topics could have hindered the dissemination of his *Pensieri diversi*, the book he strongly promoted.[175]

As a matter of fact, it is well known that the cosmos, as conceived by Aristotle, is a closed universe: nothing is found beyond the last sphere, not even the void, whose existence is excluded from Aristotelian doctrine. Before the sixteenth century, the conception of the *primum mobile* as the outer limit of the cosmos was dominant, and the infinite extension of the cosmos was only ever discussed in hypothetical terms, remaining confined to the field of theological discussions.[176] However, from now on, a reflection on the concept of space that moved away from the Aristotelian theory of place paved the way for the theorisation of the infinity of the universe by some of the most fervent anti-Aristotelians thinkers, especially those who embraced suggestions from Neoplatonism and ancient wisdom (*prisca sapientia*), people such as Patrizi and Bruno.

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[174] 'Se poi il cielo chiamato del primo mobile si muova egli, tengo di no. Come pur tengo che l'ultimo cielo non sia finito, contro i peripatetici, percioché, sendo finito, sarebbe circundato da nulla, contra quello che non si può immaginare *ut aliquid a nihilo contineatur*, e se si movesse, pur si moverebbe dentro a nulla col medesimo inconveniente', in Tassoni, *Pensieri*, II, 4, p. 420.

[175] See A. Rotondò, 'La censura ecclesiastica e la cultura', *Storia d'Italia*, 5 (1973), pp. 1399–1492.

[176] For a detailed account of this topic, see Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: Johns Hopkins University Press, 1957); Edward Grant, *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge University Press, 1981); and Antonella Del Prete, *Universo infinito e pluralità dei mondi. Teorie cosmologiche in età moderna* (Naples: La Città del Sole, 1998).

Patrizi's clear evidence for his conception of a cosmos devoid of physical boundaries can be found in the *Pancosmia*. Patrizi appeals to the concept of opposites, dear to Aristotle, to infer the existence of the infinite. Because it is tangible in everything that surrounds us, the finite itself argues in favour of the infinite. As far as Patrizi is concerned, the finite world is encompassed within an infinite universe without which the same finite world would lose its theoretical foundation. The finite is, indeed, nothing more than a part of infinity.[177] However, it is worth remembering that the infinity to which Patrizi refers does not correspond to the physical world. According to him, the physical space is the world that is perceivable and is comprised of a single matter from which the different elements (ether, earth, water, and air) are derived; these differ from each other in terms of impenetrability, solidity, and imperfection. In contrast, infinity concerns the region beyond the *primum mobile* that is conceived of as comprising 'space, light, heat, and exhalation (*fluor*).[178]

Other reasons in support of an infinite universe are grounded in the infinity and omnipotence of God, who according to his own perfection, created the infinite universe. In other words, the infinity of the world is the clearest expression of God's limitless power and goodness, and the celestial bodies are themselves animated by God and part of the cosmic harmony he created. The idea of the infinity of the universe being a consequence of God's infinite power had already been claimed by Giordano Bruno in his *De l'infinito, universo e mondi*, which was published in London in 1584.[179] Certainly, the entire system of natural

[177] Patrizi, *Nova de universis philosophia*, fols. 82 v-83 r.
[178] 'spacio, fulmine, calore, fuore, [empyreo repletus]', in Patrizi, *Pancosmia*, 83v.
[179] *De l'nfinito, universo e mondi* is the third of the cosmological dialogues written by Bruno in Italian; it follows *La cena de le ceneri* and *De la causa, principio et uno*, all three of which were published in London in 1584. However, Bruno's entire philosophical production is dominated by the idea of infinity, which also finds expression in another relevant book written in Latin: *De immense et innumerabilibus* (1591). These works are all based on considerations grounded in Copernicus' *De revolutionibus*. In *De l'infinito*, which I use here as representative of Bruno's essential ideas on the concept, we find evidence of Bruno's differences with regard to both Aristotelianism and Christian thinking as well as his distance from the hermetic sources that characterised the cosmology of these post-Copernican thinkers such as the already mentioned Patrizi. Cf. Hilary Gatti, *Giordano Bruno and Renaissance Science* (Ithaca: Cornell University Press, 1999), pp. 119–29. For a more detailed analysis of Bruno's criticism of the philosophical and theological tradition, see also M. Ángel Granada, *Giordano Bruno. Universo infinito, unión con Dios, perfección del hombre* (Barcelona: Herder, 2002), pp. 127–269.

philosophy theorised by Bruno has a theological foundation according to which the universe represents the infinite effect of the infinite cause (God). Because of his innovative theories, Bruno can be included among those figures who broke with tradition most effectively. In contrast to his predecessors, Bruno embraced Copernicanism, although he introduced amendments to the heliocentric model theorised by Copernicus himself. In fact, he refuted all the celestial spheres, including the *primum mobile*, and delineated a universe based on the absolute homogeneity of space. By combining the Copernican model with atomistic ideas, Bruno's considerations on the infinity and uniformity of space founded the possibility of the existence of an infinite number of world systems. The universe conceived by Bruno is a homogeneous entity in which a countless number of planets (bodies characterised by the prevalence of cold) revolve around another equally infinite number of suns (bodies characterised by the prevalence of heat) within a cosmological system that argues strongly for unity between terrestrial and celestial physics. [180]

In other words, Bruno's cosmological system is based on the analogy between planets/Earth and stars/Sun. This also means that no point can be considered to be the centre of the universe in an absolute sense, but only with respect to a certain system of reference: both the Earth and the other stars move, therefore each of them can be considered to be the centre of its own region.[181]

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[180] Cf. Angelika Bönker-Vallon, 'L'unità del metodo e lo sviluppo di una nuova fisica. Considerazioni sul significato del De l'infinito, universo e mondi di Giordano Bruno per la scienza moderna', *Bruniana e Campanelliana* 6, no. 1 (2000), 35–56; For a brief overview on these topics, see M. A. Granada, 'Giordano Bruno y el final de la cosmología aristotelica', in *Galileo y la gestación de la ciencia moderna* (Canarias: Consejería de educacíon, cultura y deportes del Gobierno de Canarias, Direccíon general de ordenacíon e innovacíon educativa, 2001), pp. 97−118.

[181] On Bruno's cosmological thinking, see especially: Paul-Henri Michel, *The Cosmology of Giordano Bruno*, transl. by R.E.W. Maddison (London: Methuen, 1973); A. Ingegno, *Cosmologia e filosofia nel pensiero di Giordano Bruno* (Florence: La nuova Italia, 1978). Other relevant works are Bruno's philosophy and astronomy are: Hélène Védrine, *La conception de la nature chez Giordano Bruno* (Paris: Librairie philosophique J. Vrin, 1999); Dario Tessicini, *I dintorni dell'infinito. Giordano Bruno e l'astronomia del Cinquecento* (Pisa: F. Serra, 2007).

In this way, Bruno goes further than Copernicus, who despite the fact he greatly expanded the boundaries of the cosmos with his heliocentric world system, still supported the cosmology of the enclosed and finite space. Bruno contributed significantly to the dissemination of the Copernican reasoning, which, indeed, served as the basis of his own philosophy, a philosophy whose nucleus is remarkably different to that of Patrizi. In fact, the cosmological view of the latter, by whom Tassoni seems to have been inspired, is still characterised by a sort of duality between the finite material world that we perceive and the infinite space beyond the *primum mobile*. In contrast, Bruno supports monism, which believes in an undifferentiated and infinite space that can be organised into infinite world systems. Moreover, despite areas of agreement, Patrizi's reception of Copernicanism was extremely lukewarm, and, on the whole, he considered Copernicus's cosmological system to be nothing but another complex chimera, a judgement also expressed with regard to Brahe's work.[182]

I will focus at greater length on Copernicus and Brahe in Chapter 5, which will be devoted to a discussion about the idea of the mobility of the Earth, providing more insight into Tassoni's cosmological theory. After the analysis here, it will be possible to draw some conclusions about Tassoni's engagement with the scientific debates of his time and his contribution to understanding the puzzling questions linked to the Scientific Revolution.

[182] See Patrizi, *Nova de universis philosophia*, Book 12, and in particular fol. 91r; Rosen, 'Francesco Patrizi and the Celestial Spheres', pp. 313−14.

Chapter 5: On The Immobility of the Earth

This chapter discusses the development of new cosmological models with a special focus on the topic of the mobility or immobility of the Earth. The observation of celestial novelties during the early modern era contributed to the gradual abandonment of the geocentric and geostationary system. The changes observed in the heavens undermined the commonly held tenet that the terrestrial region was subordinate to the celestial realm. Furthermore, the advancement of the hypothesis that the cosmos had an indefinite, or even infinite extension contributed to a reconsideration of the Earth-centred cosmos and laid the foundations for the geometrisation of space. The notion of space itself evolved; it started to be conceived of as a three-dimensional extension independent of the presence of bodies, and become the essential condition for all that existed.[1] Consequently, mathematical language was considered to be an adequate substitute for Aristotelian qualities; that is, it was thought that mathematics and geometry could reach the truth in the same way as qualitative philosophical analysis. The first modest signs of this evolution were found in the slow but radical process of change from a universe conceived of as a finite structure organised into two regions that were ontologically different, to one that was an infinite and homogeneous extension of space compliant with natural laws and devoid of any ontological hierarchy. These developments gave further impetus to the heliocentric conception of the cosmos. The heliocentric idea and the infinity of the cosmos had already been introduced by ancient authors, although not demonstrated by them.[2]

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[1]An interesting reflection on this topic is found in Vincenzo De Risi, 'Francesco Patrizi e la nuova geometria dello spazio', in *Locus-spatium. XIV Colloquio internazionale, Rome, 3–5 January 2013*, ed.by Delfina Giovannozzi and Marco Veneziani (Florence: Olschki, 2014), pp. 269–327.

[2] In ancient times, the Earth's rotation and the plurality of worlds was stated by Heraclides Ponticus (*c*.385–310 BC); Aristarchus of Samos (*c*.310–230 BC) hypothesised heliocentrism; Seleucus of Seleucia (150–190 BC) asserted the infinity of the cosmos; Cleomedes (first century AD) discussed the dimension of the stars as compared with the Earth; Geminus of Rhodes (first century BC) rejected the physical existence of a firmament, considering it to be only a mathematical assumption. See, for example, Lucio Russo and Emanuela Santoni, *Ingegni minuti. Una storia della scienza in Italia* (Milan: Feltrinelli, 2010), pp. 155–6.

The first to attempt a systematic organisation and explanation of heliocentrism was Copernicus in his *De revolutionibus orbium caelestium* in 1543. However, it was only when a new mechanics of the celestial bodies was developed, mostly in the works of Galileo (1564–1642), Kepler (1571–1630), and Newton (1642–1727), that the idea of heliocentrism became consolidated after a long process of change.[3]

In early modern Europe, there was strong resistance towards the new heliocentric idea from those who firmly advocated Aristotelian cosmology. Different views and debates streamed out from this cosmological clash, in which Tassoni also took part. Even if Tassoni demonstrated that he had broken away from Aristotle's influence and was open to new ideas, in this cosmological matter he defended the traditional viewpoint. By means of Tassoni's arguments against Copernicanism, I will highlight the main points in favour of geocentrism and how hard it was for the geocentric model to be disregarded.

The tensions between the standpoints of Aristotelian cosmologists and Galileo's ideas are particularly evident by looking at the way Tassoni dealt with the debates about heliocentrism and geocentrism. Tassoni's engagement with this scientific dispute is, indeed, invaluable for the comprehension of the phases and facets of the cosmological debate before the publication of Galileo's *Dialogo sopra i due massimi sistemi del mondo* (Dialogue on the Two Chief World Systems) in 1632. Galileo's *Dialogo* contains answers to criticisms made by those who adhered to geocentrism. Among these answers, one in particular seems to be a direct reply to one of Tassoni's questions. This reveals that later historiography, including our contemporary scholarship, often tends to sideline minor figures, such as Tassoni, in the scientific debates, when, in fact, they had a significant role in shaping and fuelling these discussions.

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[3] Richard Westfall, 'The Background to the Mathematization of Nature', in *Isaac Newton's natural philosophy*, ed. by Jed Z. Buchwald and I. Bernard Cohen (Cambridge MA: MIT Press, 2001), pp. 321−39;

Context of the evolution of cosmology: A step forward to the heliocentric system

It is important to bear in mind that the widespread criticism of Aristotle, which was shared by those thinkers mentioned in the previous chapters, for instance Bernardino Telesio, Tommaso Campanella, Francesco Patrizi, and Giordano Bruno, does not coincide with a clear and technical understanding of the crisis of geocentrism. Even though these authors rejected some aspects of the Aristotelian theories that were fundamental to supporting a geocentric world system, the Aristotelian–Ptolemaic order with its incontrovertible paradigms (the circular motion of the celestial bodies and the central position of the stationary Earth) continued to be the most accredited world system.[4]

Although geocentrism remained very popular, awareness of its inadequacy to explain fully the apparent movements of the planets increased. For example, the geocentric model could not provide a valid explanation for the variable distance of the planets from the Earth. More in general, although specific issues could be explained by introducing spheres, the deferent, and epicycles, the cosmos as a whole did not possess simplicity and harmony. In this sense, the theorisation of a new cosmological model by Nicolaus Copernicus (1473–1543) epitomises the dissatisfaction with the idea that the geocentric cosmological systems represented the real arrangement and functioning of the universe.[5] In fact, cosmological models that attributed motion to the Earth had occasionally been considered in the Late Middle Ages, and the idea of the Sun-centred cosmos was already present metaphorically in Pythagorean thinking. Therefore, Copernicus emerged as an innovator, who by means of the Sun-centred

[4] See Ugo Baldini, 'La teoria astronomica in Italia durante gli anni della formazione di Galileo: 1560–1610', in *Lezioni galileiane I. Alle origini della rivoluzione scientifica*, by Paolo Casini (Rome: Istituto della Enciclopedia Italiana, 1991), pp. 39–67.

[5] Before Copernicus, Islamic astronomy had already criticised the complexity of the Ptolemaic cosmological schemes. See, for example, Owen Gingerich, *The Great Copernicus Chase and Other Adventures in Astronomical History* (Cambridge: Sky Publishing Corporation and Cambridge University Press, 1992).

system aimed to present a new and real cosmological model able to question the ancient theories and solve the controversies about the ordering of the planets.[6]

In his *De revolutionibus orbium celestium* (1543), Copernicus presents a new system in which the planetary motions are based on a number of movements undertaken by the Earth, whereas the Sun is immobile and situated close to the centre of the universe. The Earth is characterised by three motions, namely, rotation, revolution, and declination, and the very centre of the universe is identified with the geometrical centre of the Earth's orbit.[7]

Copernicus used previous astronomical calculations to build up his new system, and similar to his predecessors, he explained the apparent planetary motion through a system of epicycles and deferents, which despite his intentions did not result in a more realistic or less complex method of operation. More importantly, the Copernican system not only preserved the circularity and uniformity of the celestial motion, it also seems likely that it still supported the existence of solid spheres in which the planets were embedded.[8] Therefore, Copernicus did not make the most of his intuition about heliocentrism, and he was not able to create an entirely coherent, harmonious, and realistic *systema mundi*.

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[6] See Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (Cambridge, MA: Harvard University Press, 1957); Francesco Barone, 'La modernità di Niccolò Copernico', in *Copernico e la questione copernicana in Italia dal XVI al XIX secolo*, ed. by Luigi Pepe (Florence: Olschki, 1996), pp. 1−28.

[7] For details on Copernicus and the heliocentrism, see Anna De Pace, *Niccolò Copernico e la fondazione del cosmo eliocentrico* (Milan: Bruno Mondadori, 2009).

[8] Copernicus's modernity and whether he could be considered the father of modern science has been widely discussed. Two opposite interpretations are given by Koyré in his introduction to Copernicus's *De revolutionibus orbium celestium* and by Butterfield. See Nicolaus Copernicus, *De revolutionibus orbium celestium. La costituzione generale dell'universo*, ed. by Alexandre Koyré, trans. by Corrado Vivanti (Turin: Einaudi, 1975), pp. VII-XXVII; Herbert Butterfield, 'Conservatorismo di Copernico', in *Le origini della scienza moderna* (Bologna: il Mulino, 1962), pp. 40–45. There is a vast bibliography on Copernicus's thinking, and relevant works include the following: Edward Rosen, *Copernicus and the Scientific Revolution* (Malabar: Krieger, 1984); Peter Berker, 'Copernicus and the Critics of Ptolemy', *Journal for the History of Astronomy*, 30 (1999), 343–58; Anna De Pace, *Niccolò Copernico e la fondazione del cosmo eliocentrico. Con testo, traduzione e commentario del Libro I de Le rivoluzioni celesti* (Milan: B. Mondadori, 2009); André Goddu, *Copernicus and the Aristotelian Tradition: Education, Reading and Philosophy in Copernicus's Path to Heliocentrism* (Leiden: Brill, 2010); Robert S. Westman, *The Copernican Question: Prognostication, Skepticism and Celestial Order* (Berkeley: University of California Press, 2011); Pietro Daniel Omodeo, *Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation*, 2 vols. (Berlin: Max Planck Institut für Wissenschaftsgeschichte, 2012).

Although the heliocentric model was developing, many astronomers still attempted to confirm geocentrism. By increasing the number of spheres, it was possible to make even the recent celestial discoveries *c.*1580 compatible with the traditional representation of the cosmos. Almost 50 years after the publication of Copernicus's *De revolutionibus* (1543), geocentric models were still being embraced. One pertinent example is the astronomer and teacher of mathematics Giovanni Antonio Magini (1555–1617), who in 1589 published the *Novae caelestium orbium theoricae congruentes cum observationibus N. Copernici*.[9] This does not mean that *De revolutionibus* did not have a wide circulation. On the contrary, the new planetary model theorised by Copernicus spread throughout Europe without incurring any censorship because it was put forward as a mere mathematical hypothesis to avoid any contentious political issues as far as the religious authorities were concerned. Even if Copernicus did not mean to present his theory in hypothetical terms only, in his preface to *De revolutionibus*, the German theologian Andreas Osiander applied the old epistemological notion of scientific and mathematical theories being separated from physical reality to Copernicus's model.[10]

Despite the wide circulation of Copernicus's *De revolutionibus*, the book was not easy to approach. First of all, it was written in Latin and, therefore, its audience was restricted to learned people. In addition, the text was technical; hence, it was understandable only by experts in mathematics. In this sense, Galileo's use of the Italian language was a point in favour of his propaganda, which supported heliocentrism: the Italian language simplified the challenging technical issues, and the idea of heliocentrism could reach a wider public. However, geocentrism and heliocentrism were not the only noteworthy cosmological models. Towards

[9] Enrico Peruzzi, 'Critica e rielaborazione del sistema copernicano in Giovanni Antonio Magini', in *La diffusione del copernicanesimo in Italia: 1543–1610*, ed. by Massimo Bucciantini and Maurizio Torrini (Florence: Olschki, 1997), pp. 83–98.
[10] Anna De Pace, 'Introduzione', in *Niccolò Copernico e la fondazione del cosmo eliocentrico.*

the end of the sixteenth century a new proposal achieved a broad consensus: the Tychonic system.

The Tychonic system

Tycho Brahe has already been mentioned among the protagonists in astronomy after Copernicus. He made new instruments for astronomical observation, perfected the system for calculating the position of the planets, and collected data that were widely used by his contemporaries and successors. Moreover, he also devised a cosmological model based on the geoheliocentric planetary order.[11]

Compared with the traditional system, Brahe's model consisted of the following: the Earth was still considered to be immobile and situated at the centre of the universe; the Sun and the Moon rotated around the Earth; the planets rotated around the Sun, and through this motion they also rotated around the Earth; the planetary orbits intersected at more than one point, for example, Mars's orbit intersected with the orbit of the Sun, which, in turn, passed through the orbits of both Mercury and Venus; and Mercury and Venus were placed in two orbits, the first smaller than the second, and they did not enclose the sphere of the Moon, which, instead, was enclosed by the sphere of the Sun. By emphasising the great distance between Saturn and the sphere of the fixed stars, Brahe was also able to justify the absence of parallax.

Brahe's account, which was presented in his *De mundi aetherei recentioribus phenomenis* (1588), still attracted criticism because of its incongruencies, especially with regard to the speed of the celestial bodies.[12] More in general, planetary motion could not easily be conceived of in terms of a physical description of the cosmos. Most importantly, as Osiander's preface to

[11] See John R. Christianson et al. (eds.), *Tycho Brahe and Prague: Crossroads of European Science. Proceedings of the International Symposium on the History of Science in the Rudolphine Period*, *Prague, 22–25 October 2001* (Frankfurt: Deutsch, 2002), especially pp. 21–9, 113–19, and 203–16.
[12] Westman, *The Copernican Question*, especially pp. 290–300.

De revolutionibus indicated, contemporaneous intellectuals believed that correctness should not be confused with truthfulness; in other words, correct astronomical predictions could be the result of false cosmological theories. This way of thinking had a long-lasting influence on the intellectuals, and it was also used to criticise the Tychonic system, which claimed to make a new assessment of the world. The criticism of Brahe's work by natural philosophers such as Patrizi and Ursus is a further example of the viewpoint of intellectuals with regard to the status of disciplines. As we will see, within this context, Tassoni's discourse enriches the whole picture of a transitional period in which new theories were colliding with ancient, but apparently solid, beliefs, and it helps to clarify the epistemological problem that hindered the development of new cosmological systems.

Patrizi included both the Tychonic system and Copernicanism among the chimeras aimed at saving appearances; this meant he considered them nothing more than mathematical expedients for providing a theoretical explanation of planetary motion.[13] Patrizi's scepticism with regard to the representation of the cosmos provided by the astronomers is shared by Nicolai Reymers Baer (1551–1600), who was better known as Ursus. This astronomer is mainly remembered for a controversy with Brahe himself about the primacy of the geoheliocentric hypothesis of the universe. Ursus was the author of the *Fundamentum astronomicum* (1588), the work in which he presented his geoheliocentric proposal and which received plaudits from the young Kepler. Ursus was accused by Brahe of plagiarising his cosmological model. Although there were differences between Brahe's and Ursus's proposals,

[13] In Chapter 4 it was said that in Patrizi's view, the validity of these systems was compromised by the astronomers' assumption of the reality of the celestial sphere, which was strongly denied by the natural philosophers. In hindsight, this cannot be ascribed to Brahe's idea of the cosmos because he promoted the fluidity of the heavens (as firmly claimed in his text). However, Patrizi never revised his misinterpretation of Brahe's astronomical thinking as he analysed it in Book 12 of his *Pancosmia*, not even when Brahe's assistant, Gellio Sasceride (1524–1612), demanded he correct the information in accordance with Brahe's statements. See Matjaž Vesel, 'Francesco Patrizi, a Renaissance Philosopher and the Science of Astronomy', in *Francesco Patrizi: Philosopher of the Renaissance. Proceedings from The Centre for Renaissance Texts Conference 24–26 April 2014*, ed. by Tomáš Nejeschleba and Paul R. Blum (Olomouc: Univerzita Palackého v Olomouci), pp. 314–42.

especially in relation to the Earth's rotation, which was accepted by Ursus but refuted by Brahe, the latter claimed primacy for his own astronomical theory. This controversy gave birth to Ursus's *Tractatus de astronomicis hypotesibus* (1597) and Kepler's *Apologia pro Tychone contra Ursum* (written around 1601 but left unpublished until recently). In fact, later in life, Kepler, following the request of Brahe himself, retracted his approval for Ursus, and in contrast to his initial praise for Ursus' *Fundamentum*, raised criticisms about Ursus's methodology in his own *Apologia*.[14] More importantly, Kepler disapproved of the common attitude displayed by people such as Ursus, Patrizi, and Osiander towards the astronomical hypotheses, because they considered them as separate from real cosmological models. On the contrary, Kepler was beginning to look upon mathematics and natural philosophy as synergic.

Awareness of the connection between mathematical calculations and common-sense experience when it came to formulating reliable laws was evidently increasing, but the time was still not ripe for such a notion to become widely accepted. In either 1610 or 1611, Lodovico delle Colombe (1565–1616) wrote a text on the Earth's motion that was published in 1616.[15] In this, he emphasised the subordination of mathematics to natural philosophy as far as the physical realities were concerned:

> And who does not know that it is more necessary to be a philosopher than a mathematician, and to know more about the former science than about the latter, in order to be able to judge correctly whether these theoretical and mathematical demonstrations can be suitably applied to matter, place and motion, since it belongs to natural philosophy to judge all three of these things, and not to mathematics, which abstracts natural qualities from them?[16]

[14] Nicholas Jardine, *The Birth of History and Philosophy of Science: Kepler's 'A Defence of Tycho against Ursus': With Essays on Its Provenance and Significance* (Cambridge: Cambridge University Press, 1984); Giovanna Cifoletti, 'La nuova edizione di Apologia pro Tychone contra Ursum di Keplero. Teoria e storia delle ipotesi astronomiche', *Rivista di storia della filosofia*, 42, 3 (1987), 465–80.
[15] Ludovico delle Colombe, *Contro il moto della Terra*, con *Postille* di Galileo, in Galileo, OG, III-1, pp. 251–90.
[16] 'E chi non sa, che è necessario più l'esser filosofo che matematico, e sapere più della prima scienza che della seconda, per poter rettamente giudicare, se queste teoriche e matematiche demostrazioni si possono applicare convenevolmente alla materia, al luogo e al moto, poiché alla filosofia naturale appartiene il giudicare di tutte e tre queste cose, e non alla matematica, che astrae da essa qualità naturali?', in Galileo, OG, III-1, p. 255.

The idea that mathematics was subordinate to philosophy persisted and is one reason why Galileo asked for the title of philosopher to be granted to him before moving back to the Studio Pisano in Tuscany in 1610: 'As for the title and pretext of my service, I would like, in addition to the name of Mathematician, that Your Highness would add that of Philosopher, since I profess to have studied more years in philosophy than months in pure mathematics'.[17]

Under the protection of Grand Duke Cosimo II de' Medici, Galileo was confident about the success of his propaganda in favour of the Copernican theory and its reconciliation with the Christian faith. We know things went quite differently, and it would be many years hence before Galileo's achievements would be recognised. In fact, in 1615, Cardinal Roberto Bellarmino (1542–1621), one of the most influential figures in seventeenth-century Rome, appealed to the same criterion of the supremacy of philosophy to oppose Galileo and refute heliocentrism.[18]

The controversies about different cosmological models as well as the focus on the dual role of mathematics and natural philosophy for understanding the physical reality of the world led to a renewed impetus to geometrise physics and promote heliocentrism. However, before this could take place, the Tychonic model became the privileged system insofar as it represented a compelling option for both maintaining the fundamental assumption of the immobility of the Earth, and accepting the mathematical advantages introduced by the Copernican system. The success of the Tychonic system lies in the fact that it could explain the astronomical phenomena (including Galileo's novelties, such as the phases of Venus),[19]

[17] 'quanto al titolo et pretesto del mio servizio, io desidererei, oltre al nome di Matematico, che S. A. ci aggiugnesse quello di Filosofo, professando io di havere studiato più anni in filosofia, che mesi in matematica pura', Galileo, OG, X, no. 307, p. 353. This is an excerpt from the letter sent by Galileo to Belisario Vinta on 7 May 1610.

[18] Ugo Baldini, 'Bellarmino tra vecchia e nuova scienza. Epistemologia, cosmologia, fisica', in *Roberto Bellarmino arcivescovo di Capua, teologo e pastore della Riforma Cattolica. Atti del convegno internazionale di studi, Capua 28 settembre–1 ottobre 1988*, vol. 2 of 2 Vols., ed. by Gustavo Galeota (Capua: Archidiocesi di Capua, 1990), pp. 629–90.

[19] Antonio Favaro, 'Galileo Galilei, Benedetto Castelli e la scoperta delle fasi di Venere', *Archivio di storia della scienza*, vol. 1 (1919-1920), pp. 283–96.

while being in harmony with Scriptures. Therefore, it represented a persuasive alternative to the Ptolemaic order. It was embraced especially by many Jesuits.[20]

In the following section, I will focus on the reaction of the defenders of geocentrism, which supported the Aristotelian–Ptolemaic system because of its compatibility with religious belief. The reluctance to accept cosmological novelty can be discerned in Tassoni's quesito 25 of Book IV, which, in light of this contextual analysis, can be highlighted for its historical relevance.

Between science and religion: The Jesuit order

The role played by the Jesuit order in scientific production has been widely discussed by historians, who have opposing views. On the one hand, the Jesuits' contribution to modern culture has been stressed; on the other, they were often considered adherents of an obsolete worldview based on the literal interpretation of the Scriptures. What is undeniable is that at Ignatius of Loyola's (1491–1556) behest, the Jesuits engaged in scientific research with a special focus on astronomy from the time at which the Jesuit order was founded in 1534.[21]

The physics approved by the Jesuits was derived from Scholasticism and, therefore, it supported geocentric cosmology. If we also consider that the Jesuit order was born with the aim of defending Catholic orthodoxy, it is easy to see why their natural philosophy was

[20] The first Italian textbook in which the Ptolemaic system was rejected and replaced with the Tychonic system was published in Bologna in 1620 by the Jesuit Giuseppe Biancani (1566–1624). The book was entitled *Sphaera mundi, seu Cosmographia demonstrativa ac facili methodo tradita: in qua totius mundi fabrica, una cum novis, Tychonis, Kepleri, Galilaei aliorumque astronomorum adinventis continetur: accessere I. Brevis introductio ad geographiam, II. Apparatus ad mathematicarum studium, III. Echometria, id est geometrica traditio de echo*, Bologna: Sebastianus Bonomius and Hieronymus Tamburinus, 1620. It was reprinted in Modena in 1630, in 1635, and again in 1653 (*Sphaera mundi seu cosmographia demonstrativa ac facili methodo tradita*). For a detailed account of the Jesuits, see Cristiano Casalini (ed.), *Jesuit Philosophy on the Eve of Modernity* (Leiden: Brill, 2019). For more information on early modern science and the Jesuits, see also Mordechai Feingold (ed.), *The New Science and Jesuit Science: Seventeenth-Century Perspectives* (Dordrecht: Kluwer, 2003); Paul R. Blum (ed.), *Studies on Early Modern Aristotelianism* (Leiden: Brill, 2012).

[21] Giorgio Tabarroni, 'L'inserimento dei Gesuiti nell'astronomia moderna', in *Christoph Clavius e l'attività scientifica dei Gesuiti nell'età di Galileo. Atti del Convegno Internazionale. Chieti, 28–30 aprile 1993*, ed. by Ugo Baldini (Rome: Bulzoni, 1995) pp. 159–67.

dominated by metaphysical assumptions.[22] More precisely, within the plan of studies (*curriculum studiorum*) of the religious order, metaphysics was part of the philosophy course along with natural philosophy and logic, and it provided the basis for the acceptance of physical doctrines, as well as the theoretical grounding for access to the theology course. However, this does not mean the Jesuits were indifferent to scientific achievements; in fact, their thinking often opposed the traditional worldview, as their acceptance of the geoheliocentric model shows.

The Jesuits supported the process of change in the field of celestial physics, and the fact they did so is evident if the doctrines accepted by the Jesuit Clavius are considered.[23] The later edition of his comments on the *Sfera*, which was discussed in Chapter 4, shows an openness of thinking with regard to the mutability of the heavens. Clavius was widely esteemed by his contemporaries, and is still regarded as a prominent figure in the scientific landscape for the role he played at the Collegio Romano, the most prestigious Jesuit institution in Italy, which was established in Rome in 1551,[24] and at which he taught mathematics from 1565 onwards. It is interesting to note that as a Jesuit astronomer, Clavius tried to confirm the geocentric model and rejected the mobility of the Earth principally by appealing to scientific reasoning along with common sense, rather than focusing on what was said in the Scriptures.[25] In fact, Clavius's

[22] The Jesuit order was created as a military order with the aim of retaking the area under the control of reformers. It is not possible here to analyse its contribution in the light of the Catholic reformation, but I will certainly focus on some points concerning its engagement with and its contribution to astronomical research. For more details, see, for example, Gabriele Baroncini, 'L'insegnamento della filosofia naturale nei collegi italiani dei Gesuiti 1610–1670. Un esempio di un nuovo aristotelismo', in *La ratio studiorum. Modelli culturali e pratiche educative dei Gesuiti in Italia tra Cinque e Seicento*, ed. by Gian Paolo Brizzi (Rome: Bulzoni, 1981), pp. 163–215; Ugo Baldini, *Saggi sulla cultura della Compagnia di Gesù, secoli XVI–XVIII* (Padua: Cleup, 2000) especially pp. 239–79.
[23] See, for example, Ugo Baldini, *Legem impone subactis. Studi su filosofia e scienza dei Gesuiti in Italia, 1540–1632*, (Rome: Bulzoni, 1992), especially pp. 123–27.
[24] Clavius was also held in high regard by Galileo, who submitted his own work for Clavius's consideration on more than one occasion. See, for example, Federica Favino, 'Clavio, il cosmo, il tempo', in *Magistri astronomiae dal XVI al XIX secolo. Catalogo della mostra, Roma nov. 2014–feb. 2015* (Rome: De Luca Editori, 2014), pp. 31–45.
[25] Baldini, *Legem impone subactis*, pp. 123−55; Baldini, *Saggi sulla cultura della Compagnia di Gesù*, pp. 15−49.

role reflects the discrepancy between philosophers and theologians, on the one hand, and mathematicians, on the other, with respect to astronomical innovations.

The encounter between Galileo and the Jesuits certainly played a crucial role in the process of the renewal of scientific thinking that was promoted by the Jesuit order. The accord between the Bible and Aristotelianism (in the Thomistic sense) faded, and the idea of applying mathematics to physics started to gain traction within the order too. However, the new science and philosophy, of which Galileo was a fervent promoter, modified the entire system of knowledge and, therefore, it is understandable why the process of acknowledgement by the Jesuits was gradual, and did not take place before 1630. It would be interesting to sift through the various debates that involved Galileo and the Jesuits and analyse the relationship between the two both for their mutual esteem and for the hardest-fought controversies between the two sides. However, it is not possible to attempt such an analysis here.[26] To channel the discourse towards the central issue of this chapter, that is, the mobility or immobility of the Earth, I will restrict the focus to those relevant figures who engaged with this cosmological topic.

It is possible to put the subject under discussion, that is, the mobility or immobility of the Earth, into context by first going through some stages of the Galilean experience of promoting heliocentrism. The prominent figures that emerge in this discourse are many, among them Galileo himself, the Jesuit Cardinal Roberto Bellarmino (1542–1621) and, naturally, Alessandro Tassoni. In this scientific landscape, Tassoni's opposition to heliocentrism will reveal this learned man's attitude towards the 'new science'. Strictly speaking, Tassoni was neither a mathematician nor a natural philosopher, and it will be seen how through his

[26] See, for example, George V. Coyne, 'The Jesuits and Galileo: Fidelity to Tradition and the Adventure of Discovery', *Forum Italicum*, 49 (May 2015), 154–65; Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?* (Cambridge: Cambridge University Press, 1995); Massimo Firpo and Vincenzo Ferroni, 'Galileo tra inquisitori e microstorici', *Rivista storica italiana*, 97, 1 (1985), 177–238; Andrea Battistini, *Galileo e i Gesuiti. Miti letterari e retorica della scienza* (Milan: Vita e pensiero, 2000); Galileo Galilei and Mario Guiducci, *Discorso delle comete*, ed. by Ottavio Besomi and Mario Helbing (Rome: Editrice Antenore, 2002), pp. 18–21; Luigi Ingaliso, *Filosofia e cosmologia in Christoph Scheiner* (Soveria Mannelli: Rubbettino, 2005).

intellectual opposition to Galileo, he forged his own personal and multifaceted vision of the cosmological world system. In this, to describe the reality as he saw it, he stood on the traditional side of the philosophical qualitative analysis.

THE COPERNICAN THEORY: BETWEEN PROPAGANDA AND HOSTILITY

Galileo and Copernicanism

Galileo's acceptance of Copernicanism predates his public, but still cautious, declaration of support that occurred in the context of three lessons devoted to discussing the appearance of the nova in 1604, during the period he taught mathematics in Padua.[27] However, it was only from 1609 onwards that his theoretical acceptance of the heliocentric system was supported by astronomical findings.[28]

By observing the sky using a telescope, Galileo noticed the irregularities of the Moon's surface, he was able to understand the nature of the Milky Way (clusters of stars) and discovered the satellites of Jupiter (Galilean moons). This latter finding is particularly important because it could be considered as proof of the existence of a centre of motion other than the Earth; indeed, the moons of Jupiter were the first celestial bodies found to revolve around a body that was neither the Earth nor the Sun. In general, these observations presented by Galileo in his *Sidereus nuncius* (1610), along with his further achievements such as the discovery of the phases of Venus, the sunspots, and his observation of an unusual protuberance on Saturn (identified in 1655 by Christiaan Huygens as Saturn's rings) demonstrated that the Ptolemaic system was not compatible with a realistic description of the cosmos. Three years

[27] There are two letters that testify to Galileo's inclination towards the Copernican scheme; they are addressed to Jacopo Mazzoni and to Kepler, and are both dated 1597, see Galileo, OG, X, no. 56 and no. 57, pp. 67–8.
[28] See Massimo Bucciantini, Michele Camerota, and Franco Giudice, *Galileo's Telescope: A European Story*, trans. by Catherine Bolton (Cambridge, MA: Harvard University Press, 2015).

later, in 1613, Galileo explicitly supported the Copernican system for the first time – in his *Lettere intorno alle macchie solari* of 1613.[29]

Soon after, hostile reactions from the academic community, which was steeped in Aristotelian teachings, arose. The prevailing scepticism was easy to justify: the telescope was still a rudimentary instrument and did not provide a clear, uniform view of the sky and its bodies for any user; this resulted in different interpretations of the phenomena observed being put forward, and they were often in conflict with Galileo's claims.

One case in point is Cesare Cremonini (1550–1631), who taught natural philosophy in Padua and was Galileo's colleague. Being a fervent Aristotelian, Cremonini rejected Galileo's interpretation of the phenomena observed and, therefore, refused to consider this as a challenge to the traditional geocentric order.[30] In a letter dated 29 July 1611 that Paolo Gualdo (1553–1621) sent to Galileo, he referred to Cremonini's scepticism with regard to the use of the telescope for celestial observations: 'that wondrous looking through those glasses stuns my head: enough, I don't want to know more about it'.[31] However, Cremonini was not an isolated voice. The literature opposing Copernicanism proliferates, in contrast to the few voices that supported this system.

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[29] The information about Galileo and his work that appears in my study is mainly based on Michele Camerota, *Galileo Galilei e la cultura scientifica nell'età della Controriforma* (Rome: Salerno, 2004). The bibliography on Galileo and the cultural climate of the early modern era is abundant, and some of most relevant works are as follows: Stillman Drake, *Galileo Studies. Personality, Tradition and Revolution* (Ann Arbor, MI: University of Michigan Press, 1970); Stillman Drake, *Galileo at Work. His Scientific Biography* (Chicago: University of Chicago Press, 1978); Stillman Drake, 'Galileo's Steps to Full Copernicanism and Back', *Studies in History and Philosophy of Science*, 18 (1987), pp. 93–105; William R. Shea, *Galileo's Intellectual Revolution* (London: MacMillan, 1972.); Maurice Finocchiaro, *Retrying Galileo, 1633–1992* (Berkeley: University of California Press, 2005); Maurice Finocchiaro, *Defending Copernicus and Galileo: Critical Reasoning in the Two Affairs* (New York: Springer, 2010); Maurice Finocchiaro, *On Trial for Reason: Science, Religion and Culture in the Galileo Affair* (Oxford: Oxford University Press, 2019); Pietro Redondi, *Galileo eretico* (Rome: Laterza, 2009).

[30] Marco Forlivesi, 'Politica e scienza tra XVI e XVII secolo: gli esempi di Cesare Cremonini e Galileo Galilei', *Atti e memorie dell'Accademia Galileiana di scienze lettere ed arti in Padova, già dei Ricovrati e Patavina. Pt. 3, Memorie della Classe di scienze morali lettere ed arti*, 125 (2012–13), 3–34; Luca Bianchi, 'Hauendo lui publicato sette fogli di carta: Leandro Pizzoni e la reputazione scientifica di Galileo', *Rivista di storia della filosofia*, 71, suppl. 4 (2016), 16–44.

[31] 'quel mirare per quegli occhiali m'imbalordiscon la testa: basta, non ne voglio saper altro', in OG, XI, no. 564.

Hostile reactions were also fuelled by the incompatibility between heliocentrism and the astronomical references present in the Scriptures. There are a number of events that reflect the climate of the time, which opposed Galileo's cosmological position. In 1612, when the Dominican friar Niccolò Lorini (1544–1617) was in conversation with the Grand Duke of Florence, he introduced the suspicion that Galileo's stance in support of the Copernican view was heretical. In addition, the Dominican Tommaso Caccini spoke out against Galileo during his sermon in the Santa Maria Novella in 1614. Similarly, in 1613, Galileo's assumptions about the motion of the Earth were questioned by means of theological arguments in the context of a discussion about matters of science and faith that took place in Pisa. This involved the Grand Duke Cosimo II de' Medici, his wife Maria Maddalena d'Austria and his mother, the Grand Duchess Christina of Lorraine, along with the professor of philosophy Cosimo Boscaglia, and Benedetto Castelli. Castelli, who had been one of Galileo's scholars, skilfully responded to the accusation of heresy moved by Boscaglia against Galileo, and he also informed his master about the intellectual exchange in which he had taken part. Details of this episode were reported to Galileo by another of his students, Niccolò Arrighetti. The *Lettera a Benedetto Castelli* (1613), which was written by Galileo with the aim of clarifying his position with regard to the relationship between religion and science, originated from this episode. This was one of the first concrete signs of the battle to free science from any interference in general, and from religious control in particular. A copy of the letter to Castelli was sent by the Dominican friar Lorini to Camillo Sfrondati in Rome, who was the prefect of the Congregation of the Index, with the intention of raising an official complaint about Galileo. As soon as Galileo became aware of this, he sent another version of the letter to Piero Dini on 16 February 1615, with the request that this be circulated to refute any possible misconceptions caused by the version sent by Lorini, which had probably been modified.[32] In fact, the two versions of the letter show

[32] Cf. Galileo, OG, V, pp. 291–95.

some differences. However, Galileo's copy of the letter to Benedetto Castelli, recently found in the library of the Royal Society in London, reveals that the Dominican friar did not in fact manipulate the letter. Rather it was Galileo himself who amended his first version with the aim of changing content that could have caused problems with the Inquisition. In essence, Galileo tried to emphasise the interpretative problems that arose when approaching the reading of the Scriptures and to attribute those statements that opposed the Copernican vision of the world to hermeneutical issues.[33]

In 1615, Galileo addressed another letter to the Grand Duchess Christina of Lorraine, which can be considered an extended version of the one sent to Castelli. Galileo was aware that the influence of the Grand Duchess could orientate the entire political entourage towards an anti-Copernican position; therefore, it was extremely important to express his position on the relationship between science and religion clearly. However, Galileo's attempt to make the field of science completely independent from the field of religion was not successful. In fact, he was forced to show his intention of abandoning the Copernican theory not long afterwards, as we will see.

Against this background composed of fervent anti-Galileans it is hardly surprising that the voices in support of Galileo were condemned to failure. The text published in Naples by the Carmelite Paolo Antonio Foscarini (1565–1616) is a case in point.[34] In his *Lettera sopra l'opinione de' Pittagorici, e del Copernico, della mobilità della terra e stabilità del sole, e del nuovo Pittagorico sistema del mondo* (1615), Foscarini supported Galileo, and attempted to demonstrate that there was some agreement between certain biblical excerpts and the

[33] The manuscript of Galileo's letter to Castelli was found by Salvatore Ricciardi in 2018. For information about this letter, its finding and its historical context, see Michele Camerota, Franco Giudice, and Salvatore Ricciardo, *Galileo ritrovato. La lettera a Castelli del 21 dicembre 1613* (Brescia: Morcelliana, 2019).
[34] Paolo Antonio Foscarini, *Foscarini e la sua lettera sulla mobilità della terra. Scienza e fede nell'opera del carmelitano montaltese. Testo integrale della Lettera sopra l'opinione de'Pittagorici e del Copernico, della mobilità della Terra e stabilità del Sole e del nuovo pittagorico sistema del mondo* (1615), ed. by Luciano Romeo (Cosenza: Editoriale progetto 2000, 2018).

heliocentric system; however, the reaction from Cardinal Roberto Bellarmino was exactly the opposite he had hoped for: 'all agree in claiming *ad litteram* that the Sun is in the heavens and turns around the Earth with supreme speed and that the Earth is very far from the heavens and is motionless in the center of the world'.[35] These words are taken from the letter written by Cardinal Roberto Bellarmino to Foscarini in 1615; heliocentrism was considered to be completely at odds with the Scriptures and, therefore, it could be presented only as a mere mathematical hypothesis.[36] The letter that Bellarmino sent to Foscarini shows the most common reaction of theologians to the new world system: hostility.

Nevertheless, it is worth remembering, once again, that the radical rejection of heliocentrism does not correspond to the uncritical acceptance of Aristotelian cosmology. The acceptance of the literal interpretation of the Scriptures implied the preservation of a geocentric scheme of the universe, but the idea of the cosmos supported by Bellarmino himself includes elements different from the traditional view and linked to non-Aristotelian philosophies. Bellarmino, indeed, conceived of the cosmos in a way that is partially compatible with the Tychonic system: a geocentric structure enclosed in a single sphere (the sphere of the fixed stars), made of a fluid matter within which the stars could move, and in which the occurrence of new phenomena was possible. In other words, the defence of geocentric cosmology, which was embedded in the Christian religion, was configured principally as the defence of the truth

[35] 'tutti convengono in esporre *ad literam* ch'il sole è nel cielo e gira intorno alla terra con somma velocità e che la terra è *lontanissima* dal cielo e sta nel centro del mondo, immobile', in Galileo Galilei, *Scienza e religione: scritti copernicani*, ed. by Massimo Bucciantini and Michele Camerota (Rome: Donzelli, 2009), p. 158.

[36] For the central points of the letter written by Bellarmino to Foscarini, see also Franco Motta, *Roberto Bellarmino. Teologia e potere nella Controriforma*, ed. by Michela Catto (Milan: Il sole 24 ore, 2014), especially p. 227; for more details on Bellarmino's rejection of heliocentrism, see also Franco Motta, 'I criptocopernicani. Una lettura del rapporto fra censura e coscienza intellettuale nell'Italia della Controriforma', in *Largo campo di filosofare. Eurosymposium Galileo 2001*, ed. by José Montesinos and Carlos Solís (La Orotava: Fundación Canaria Orotava de Historia de la Ciencia, 2001), pp. 693–718; Franco Motta, *Bellarmino. Una teologia politica della Controriforma* (Brescia: Morcelliana, 2005).

value of the Scriptures, which was undermined by the assumptions supported by people such as Galileo and Foscarini.[37]

Bellarmino did not keep his opinions on the matter to himself and, naturally, they spread: Federico Cesi (1585–1630), who was the founder of the Accademia dei Lincei, informed Galileo about Bellarmino's reaction to heliocentric cosmology; Cardinal Maffeo Barberini (1568–1644) advised Galileo to be cautious when dealing with the new cosmological model; and, similarly, Cardinal Francesco Maria del Monte (1549–1627) discouraged the use of biblical arguments to support Copernicanism. However, the Roman Curia's overall negative reception of his assumptions was underestimated by Galileo himself, who had probably been reassured, at least initially, by his friends Giovanni Ciampoli (1589–1643) and Piero Dini (†1625), who were familiar with the Roman intellectual and religious circles.[38]

Therefore, Galileo's heliocentric propaganda continued, but measures against the dissemination of heliocentric ideas were also taken and Galileo's attempt to defend his position failed. In fact, on 10 December 1615, Galileo was in Rome, trying to persuade the authorities of the correctness of Copernicanism, although unsuccessfully. Antonio Querenghi's letters to Cardinal Alessandro d'Este refer to gatherings that included Galileo and other learned men in which Copernicanism was the object of lively debate:[39]

> Here there is Galileo, who often, in meetings of men of rare intellect, makes wonderful speeches about the opinion of Copernicus, believed by him to be true, that the Sun is in the center of the world, and the Earth and the other elements as well as the heavens go around

[37] Richard J. Blackwell, *Galileo, Bellarmine and the Bible: Including a Translation of Foscarini's Letter on the Motion of the Earth* (Notre Dame: University of Notre Dame Press, 1991). It is worth mentioning that Foscarini approached the cosmological discourse in a different way from Galileo, that is, in terms of hypotheses, not in terms of reality. To a certain extent, therefore, he is closer to Bellarmino's way of thinking than to Galileo's; about this topic, see Stefano Caroti, 'Un sostenitore napoletano della mobilità della terra. Il padre Paolo Antonio Foscarini', in *Galileo e Napoli*, ed. by Fabrizio Lomonaco and Maurizio Torrini (Naples: Guida, 1987), pp. 81−121.

[38] For a detailed account on this scenario, see Paolo Galluzzi, *The Lynx and the Telescope: The Parallel Worlds of Cesi and Galileo*, transl. by Peter Mason (Leiden: Brill, 2017), in particular pp. 170−220.

[39] See U. Motta, Querenghi e Galileo: l'ipotesi copernicana nelle immagini di un umanista, *Aevum*, 67, fasc. 3 (1993), 595–616.

> it [the Sun] with perpetual motion. Most of the time he comes back to the house of Mr. Cesarini, out of respect for Mr. Virginio, who is a young man of the highest intellect.[40]

By means of Querenghi's letters to the cardinal it is also known that rumours were circulating about Galileo's journey: it was thought Galileo had gone to Rome because he had been summoned by the religious authorities, and that he did not go of his own accord: 'his coming to Rome is not, as was believed, at all voluntary, but because he was required to explain how he supported the circular movement of the Earth and the [Copernican] doctrine [which is] contrary in all ways to Holy Scripture'.[41]

Even if there was little support for his new way of thinking, Galileo was still so confident about the success of his propaganda in favour of the Copernican theory that he firmly defended it by invalidating the arguments of his intellectual enemies: 'those fifteen and twenty who make cruel attacks on him, now in one thing and now in another. But he stands firm in such a way that he laughs at all. And even if the novelty of his opinion does not persuade, it nevertheless shows as vain most of the arguments with which critics try to knock him down'.[42] Galileo was also confident that Copernicanism could be reconciled with the Christian faith; however, things went quite differently and it would take many years before his achievements would be recognised.

In 1616, the Aristotelian Francesco Ingoli (1578–1649) wrote the *Disputatio de situ et quiete Terrae contra Copernici Sistema disputatio*, and in the very same year, the Holy Office in Rome condemned the Copernican system. On 26 February 1616, Bellarmino warned Galileo

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[40] 'Abbiam qui il Galileo, che spesso, in ragunanze d'uomini d'intelletto curioso, fa discorsi stupendi intorno all'opinione del Copernico, da lui creduta per vera, che 'l sole stia nel centro del mondo, e la terra e 'l resto de gli elementi e del cielo con moto perpetuo lo vadano circondando. Si reduce il più delle volte in casa dei signori Cesarini, per rispetto del signor Virginio, ch'è giovinetto d'altissimo ingegno', in Galileo, OG, XII, p. 212.

[41] 'la sua venuta a Roma non è, come si credeva, affatto voluntaria, ma che si vuole farli render conto come salvi il movimento circular della terra e la dottrina, in tutto contraria della Sacra Scrittura', in Galileo, OG, XII, p. 220.

[42] 'in mezzo di quindici e venti che gli danno assalti crudeli, quando in una cosa e quando in un'altra. Ma egli si sta fortificato in maniera che si ride di tutti. E se bene non persuade la novità della sua opinione, convince nondimeno di vanità la maggior parte degli argomenti co' quali gli oppungnatori cercano di atterrarlo', in Galileo, OG, XII, p. 226–27.

to abandon the Copernican theories because they were considered to be in conflict with the dogmas of the Church.[43] Therefore, the result of Galileo's battle was thought to be 'fumo d'alchimia' (smoke of alchemy), an expression used by Querenghi in another letter sent to Cardinal Alessandro d'Este on 5 March 1616: 'Mr. Galileo's disputes are determined [to be] in [the] smoke of alchemy, the Holy Office having declared that to hold that opinion means to dissent from the infallible dogmas of the Church'.[44]

Contextually, *De revolutionibus* was added to the Index of Prohibited Books subject to revision (*donec corrigatur*), whereas Foscarini's work *Lettera sopra l'opinione de' Pittagorici, e del Copernico* was forbidden altogether.[45]

The process of amending *De revolutionibus* started on 6 March 1616 through the work of Cardinal Bonifacio Caetani (1568–1617). It was continued by his secretary Francesco Ingoli and published in May 1620. Essentially, Ingoli turned what Copernicus had expressed in an assertive way into hypothetical arguments, which was a suitable tone for astronomical matters.[46]

Galileo's promotion of Copernicanism continued, even though he was aware of the lack of some incontrovertible proof that would silence his opponents, whose numbers were continually increasing. The election of Maffeo Barberini to the papacy as Pope Urban VIII on 6 August 1623 was considered by Galileo to be a positive event that could help him to achieve his aim. Indeed, the former Cardinal Barberini had always thought highly of Galileo.

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[43] For more details on Galileo's trial, see Camerota, *Galileo Galilei*, p. 315; Massimo Bucciantini, Michele Camerota, and Franco Giudice (eds.), *Il caso Galileo, una rilettura storica, filosofica e teologica. Convegno internazionale di studi, Florence, 26–30 May 2009* (Florence: Olschki, 2011), especially pp. 259–75; Natacha Fabbri and Federica Favino (eds.), *Copernicus Banned: The Entangled Matter of the Anti-Copernican Decree of 1616* (Florence: L.S. Olschki, 2018).

[44] 'Le dispute del Sig. Galileo son risolute in fumo d'alchimia, avendo dichiarato il Santo Ufficio che 'l sostenere quella opinione sia un dissentir dai dogmi infallibli della Chiesa', in Galileo, OG, XII, p. 243.

[45] See 'Cronologia', in Galileo, *Scienza e religione*, pp. XLVII– XLVIII.

[46] Luigi Guerrini, *Cosmologie in lotta: le origini del processo di Galileo* (Firenze: Edizioni Polistampa, 2010), pp. 197–98.

Furthermore, the new Pope was also highly regarded by the elite of the intellectual community because of his reputation as a poet and learned man, and for his openness towards the cultural novelties of the time. The Pope was surrounded by higly respected intellectuals such as Giovanni Ciampoli, Virgilio Cesarini, Cassiano dal Pozzo, and other members of the Accademia dei Lincei, which the Pope's nephew Francesco Barberini also joined the day before he was promoted to the position of cardinal by his uncle on 2 October 1623. Urban VIII was himself interested in the cultural products of his time and he very much liked Galileo's *Saggiatore*, which the author dedicated to him after a suggestion by the Linceans.[47] Hence, there were reasons for the optimistic climate fostered by this particular pope. As a consequence, Galileo planned another journey to Rome to honour the Pope and discuss again the heliocentric vision of the universe, in the hope that this time, the epistemological criteria previously imposed by Bellarmino, as well as by Urban VIII himself, could be overcome. Both Bellarmino and Urban VIII had appealed to the absolute power of God (*potentia Dei absoluta*) to define the limits of human knowledge; in this sense, heliocentrism could never have been proved real.[48] Conversely, according to Galileo, human beings could achieve a true understanding of nature through mathematics, which emerged as the real language through which 'the book of the world is written'[49]. Already expressed in his *Saggiatore*, this argument also found a place in Galileo's *Dialogo sopra i due massimi sistemi*, a book written mostly between 1624 and 1629 and published in Florence in 1633.

[47] For information on the Accademia dei Lincei and the personalities here mentioned, especially Cesarini, Ciampoli, Maffeo and Francesco Barberini, see E. Bellini, *Umanisti e Lincei. Letteratura e Scienza a Roma nell'Età di Galileo* (Padua: Antenore, 1997). For more details, see Bellini, *Stili di Pensiero,* pp. 67−157.
[48] Luca Bianchi, 'Uccelli d'oro e pesci di piombo. Galileo Galilei e la potentia Dei absoluta', in *Sopra la volta del mondo: onnipotenza e potenza assoluta di Dio tra Medioevo e età moderna*, ed. by M. T. Fumagalli and Beonio Brocchieri (Bergamo: Lubrina, 1986), pp. 139–46; M. Ángel Granada, *Palingenio, Patrizi, Bruno, Mersenne. El enfrentamiento entre el principio de plenitud y la distinción potentia absoluta/ordinata Dei a propósito de la necesidad e infinitud del universo* (Milan: Angeli, 2000).
[49] Galileo, OG, VI, p. 232.

This book can be taken as a sign of Galileo's tenacity with regard to the defence of his theoretical stance. Even if he was aware that the different meetings with the religious authorities had not succeeded in persuading the Pope to redact the anti-Copernican measures of 1616, he still decided to reveal his cosmological theories. In June 1624 Galileo went back to Florence ready to conclude his work concerning the two chief world systems.[50]

Tassoni's quesito (IV, 25) opposing Galileo: Historical context

As we have seen, during the first three decades of the seventeenth century, the Italian cultural landscape was animated by the Copernican question, and Rome became the centre of rumours about Galileo that spread widely throughout Europe. Tassoni belongs to that group of learned men who reacted against Galileo's propaganda in favour of heliocentrism. Indeed, even if Copernicus was the main representative of this new planetary arrangement, when Tassoni decided to devote a *quesito* in his *Pensieri diversi* to this topic, he said little about the astronomer, declaring that he had not read *De revolutionibus* and, consequently, he had only an indirect knowledge of Copernicus's theories.

The *quesito* entitled *Se la terra si muova* (Whether the Earth moves) is explicitly written with the intention of invalidating the idea of the motion of the Earth conveyed by Copernicanism but brought to new life by Galileo. On 5 March 1616, the very day on which the Congregation of the Index issued the decree declaring that the theories of the mobility of the Earth and the central position of the Sun in the universe were false and at odds with the Scriptures, Tassoni wrote to Alberto Barisoni from Rome, 'I have ready the question of the motion of the Earth against Galileo, whose opinion has been declared heretical here. If it is

[50] For an exstensive study on Galileo's heliocentrism, see Anna De Pace, *Galileo lettore di Copernico* (Firenze: Olschki, 2020).

necessary to send it, I will send it to be added to the fourth book; and it will be very intriguing'.[51]

During this period, books defending the traditional world view proliferated, making its promoters very visible, and whether Tassoni decided to write opposing Galileo more because of opportunism or because of conviction is difficult to say; both options are reasonable. On the one hand, considering the many historical occurrences of a similar situation, participating in a cosmological debate about such a contentious issue could be a breeding ground for the desired editorial success of his *Pensieri diversi* and an opportunity to achieve fame. On the other hand, if the assumption of the motion of the Earth gained favour, it would certainly, and considerably too, invalidate Tassoni's natural philosophy. Indeed, Tassoni had grounded the immobility of the Earth in the natural principle according to which immobility resulted from bodies being cold; conversely, motion occurred because bodies were hot. Consequently, because the Earth was a cold element, it had to be stationary. Therefore, the defence of the immobility of the Earth may have been due to a strong involvement with the topic itself, as will be seen by presenting the arguments put forward by Tassoni in support of this belief.

There is no doubt that Tassoni was instrumental in keeping the focus on the debate about Copernicanism for years, during which time the campaign against Galileo became more and more severe. Of course, Tassoni knew all about the recent events involving Galileo, the Jesuits, and the Roman Curia: he was in Rome, where he had lived—except for one temporary move—since 1597 and where he was acquainted with members of the Roman cultural entourage, including those figures who had played a role in the events leading up to the condemnation of Galileo.[52] In addition, as has been seen in Chapter 2 of this thesis, despite the fact that Tassoni

[51] 'Io ho in pronto il quesito del moto della terra contra il Galileo, la cui opinione qui è stata dichiarata ereticale. Se occorrerà mandarlo, lo manderò per aggiugnerlo al quarto libro; e sarà curioso assai', in Tassoni, *Lettere*, vol. 1, p. 259.
[52] See Chapter 1, Section 1.3.

was intensely committed to a new edition of his *Pensieri diversi* around 1615–16, the negotiations for publishing this dragged on. Tassoni continued to rework his book and added material that could hopefully attract the attention of editors. In a letter sent to Barisoni on 20 February 1616, Tassoni declared:

> Now coming to my book of *Pensieri*, Your Lordship would be my tutelary Jupiter if you could find the arguments that one says in order to calm these dragons of booksellers so that they reprint it [my book] there under your eyes. If that Ciotti were the man that he should be, he would calm them [the booksellers] with the two hundred copies that he wants; but he has had such poor success with the rest that not even in this can he be trusted. All my hope is in the ingenuity of Your Lordship, but it is necessary to send the copies to Padua because these bookshops, seeing the curiosities that are added, will perhaps become so fond of them that they will make a better negotiation.[53]

Considering Tassoni's commitment to publishing a new edition of the *Pensieri diversi*, it is at least conceivable that during this particular period, a *quesito* opposing the motion of the Earth could potentially represent a further favourable addition towards achieving his aim. On 12 March 1616, again writing to Albertino Barisoni, Tassoni commented: 'I have finished the question about the motion of the Earth and I will send it, as I know I can send it, to be added to the fourth book'.[54] Then, two months later, yet again to the same addressee, he said:

> At the end of the book there is the question of the motion of the Earth, sewn with a thread that Your Lordship will be able to cut and remove; and there are added the corrections of the two places of the fifth and sixth book of the *Varietà*, which I had sent to Ciotti. [...] Your Lordship, please, add them immediately so that you do not forget them; and give the question of the motion of the Earth to the Inquisitor for him to review since I do not believe that there will be any issues with it.[55]

[53] 'Or venendo al mio libro de' *Pensieri*, V. S. sarebbe il mio Giove tutelare, s'ella trovasse gli argigogoli che dice per adormentare cotesti dragoni di librai sì che il ristampassero costì sotto gli occhi Suoi. Se quel Ciotti fosse l'uomo che dovrebbe essere, gli adormenterebbe egli con le duegento copie che vuole; ma egli ha fatto così trista riuscita nel resto che neanco in questo gli si può credere. Tutta la mia speranza è nell'ingegno di V. S. ma bisogna far venir le copie a Padova, perchè cotesti librari, vedendo le curiosità che vi sono aggiunte, forse vi si affezioneranno di sorte che faranno miglior partito', in Tassoni, *Lettere*, I, p. 258.

[54] 'Io ho la quistione finite del moto della terra e la manderò, com'io sappia di poterla mandare, per aggiugnerla al quarto libro', in Tassoni, *Lettere*, I, p. 261.

[55] 'In ultimo del libro vi è la quistione del moto della terra, cucita con un filo che V. S. potrà tagliare e levarla; e vi sono aggiunte le correzioni dei due luoghi del quinto e del sesto libro della *Varietà*, le quali io avea mandate al Ciotti. [...] V. S., di grazia, le aggiunga subito acciò non se ne scordi; e la quistione del moto della terra la dii a rivedere all'Inquisitore, ch'io non credo che in essa vi sarà difficultà', in Tassoni, *Lettere*, I, p. 280.

The years between 1616 and 1620 were characterised by the failure of publishing agreements with editors in Venice, Rome, Padua, and Modena, which determined further adjustments to the book.[56]

The same *quesito* opposing the motion of the Earth was subject to change, confirming Tassoni's involvement in the topic. The *quesito* was reworked even after the revised edition was published in Carpi in 1620.[57] Comparing the edition of 1620 and the following one, which was published in Venice in 1627, it is possible to ascertain that the text of the *quesito* has been slightly extended in the later volume. The addition has been placed at the end of the arguments that Tassoni presents to show that the Copernican hypothesis is contrary to 'the widespread opinion, to the nature, to the astronomy, to the religion' and it is even 'against both the common sense and physical and mathematic reasons'.[58] The content of the *quesito* will be presented in the following section (Tassoni's opposition to Copernicanism: Arguments and sources); here, suffice to say that the part added confirms that the *quesito* was, in fact, written in two different periods. After having exposed his arguments opposing the motion of the Earth, Tassoni added the following: 'These reasons were written by me, not against Copernicus, whose book I had not yet read, but against some who did not report his doctrine as it stands'.[59] Tassoni's words hinted at the possibility that after having written the first version of the *quesito* (published in the 1620 edition), he had then read Copernicus's book and noted that the heliocentric

[56] For more information about the failure of the publishing agreements with editors in Venice, Rome, Padua, and Modena before 1620, see Tassoni, *Lettere*, I, in particular no. 257 (15 Apr. 1615), no. 260 (23 May 1615), no. 265 (19 Jun. 1615), no. 267 (27 Jun. 1615), no. 268 (4 Jul. 2015), no. 289 (20 Nov. 1615), no. 306 (23 Jan. 1616), no. 308 (5 Feb. 1616), no. 310 (20 Feb. 1616), no. 319 (16 Apr. 1616), no. 322 (22 Apr. 1616), no. 324 (7 May 1616), no. 325 (15 May 1616), no. 328 (23 May 1616), no. 350 (26 Nov. 1616), no. 397 (27 Oct. 1617), no. 417 (25 May 1618), and no. 418 (30 May 1618).

[57] The developing relationship between Galileo and the Roman Court after 1624 is included by Puliatti among the events that determined the revision of the book, especially with regard to the changes made in relation to the topic about the Earth's motion. Indeed, as we have seen, Galileo went to Rome after Cardinal Maffeo Barberini was elected Pope in an attempt to give a new impetus to Copernicanism. See the information provided by Puliatti in Tassoni, *Pensieri*, p. 992).

[58] '[come ella] è contra la comune, [così è contra] la natura, contra l'astronomia, contra la religione, conta il senso e contra le ragioni fisiche e matematiche', in Tassoni, Pensieri, IV, 25, p. 512.

[59] 'Queste ragioni furono scritte da me, non contra il Cupernico, il cui libro io non havevo veduto ancora; ma contro di alcuni, che non riferivano la sua dottrina, com'ella sta', in Tassoni, *Pensieri*, IV, 25, p. 517.

hypothesis was actually more complex than he had first thought. In particular, it ascribes three, rather than two different motions to the Earth as well as mentioning the rotation of Mercury and Venus around the Sun in orbits that had diameters smaller than that of the Earth:

> Now Copernicus does not give only two motions to the Earth, as these reported, but three: namely, one in itself, as has been said, from west to east in 24 hours; the other also from west to east, but around the circle of Venus in one year; and the third on the sides from north to south and from south to north, by which he proves the inequality of the days and the changing of the seasons. And he places the Moon in the same space between Mars and Venus, so that it turns around the Earth in a particular epicycle, while it too, like the Earth, is brought into the said epicycle towards the east.[60]

The fact that Tassoni became acquainted with the peculiarities of the Copernican system had consequences for his discussion of the topic. In fact, Tassoni included a consideration about the occurrence of eclipses among the reasons he was opposed to Copernicanism.

According to Tassoni, the interchange of positions between the Earth and the Sun would prevent the occurrence of both solar and lunar eclipses.[61] On the one hand, if the Earth were located beneath the Moon, a solar eclipse would be impossible; in this case, the Moon would be located above both the Sun and the Earth without there being any possibility of it coming between them. On the other, if the Earth were located above the Moon, this would impede its interposition between the Moon and the Sun, the very location that was responsible for the lunar eclipses. Because the eclipses occurred in nature, the incompatibility between a heliocentric scheme and this astronomical phenomenon represented a good argument for invalidating the new hypothesis. However, this viewpoint did not consider the real positions of the Earth and Moon in the Copernican scheme, according to which the Moon is located in the same space as the Earth, but in a separate epicycle that rotates around the Earth, while the Earth

[60] 'Ora il Cupernico non dà solamente due movimenti alla terra, come riferivano questi; ma tre: cioè uno in se stessa, come s'è detto, d'occidente in oriente in 24 ore; l'altro pur d'occidente in oriente, ma d'attorno al cerchio di Venere in un anno; e'l terzo ne' lati da settentrione a mezzogiorno e da mezzogiorno a settentrione, col quale salva l'inegualità de' giorni e'l variare delle stagioni. E mette la luna nello stesso spazio tra Marte e Venere che in un epiciclo particulare si va girando dintorno alla terra mentre anch'essa, come la terra, è portata nel detto epiciclo verso oriente', in Tassoni, *Pensieri*, IV, 25, p. 517.
[61] Tassoni, *Pensieri*, IV, 25, pp. 512–13.

itself moves eastward. Consequently, once Tassoni became more aware of Copernicus's theory, his own argument was invalidated.

In fact, the planetary assessment made by Copernicanism does not prevent the occurrence of eclipses. Furthermore, if it is properly understood, the planetary scheme theorised by Copernicus also explains the variation of the positions of Mercury and Venus, showing them sometimes appearing above the Sun, as other astronomers believed, for example, Alpetragius, Plato, and Capella.[62]

Needless to say, this acknowledgement of some of the features of Copernicanism does not convince Tassoni about the reality of this physical model, and he reiterates his opposition to heliocentrism; the scheme proposed by Copernicus appeared to him to be complex and artificial: 'that new epicycle, which carries the Moon through the space of the fourth sphere, also needs machines and windmills to explain all occurrences, especially because that third motion of the Earth at its sides cannot occur without the Earth moving obliquely'.[63] Moreover, Tassoni is not able to explain why the Moon's period of rotation was equal to its motion of revolution, and why there was compatibility in terms of time with the Earth's rotation, whereas there was a huge difference between the periods of revolution of the two bodies; the Moon, in fact, took a sidereal month (this lasts around twenty-seven days, which is the length of time the Moon takes to revolve around the Earth with respect to the background stars), whereas the Earth's period of revolution lasted one year:

> I add that, as for the Moon, if it turns together with the Earth in the same epicycle, as Copernicus avers; and the Earth in twelve months moves through its main route, passing under the twelve signs of the Zodiac; I do not understand how the Moon, which never departs from the Earth, passes through all the same signs in only thirty days, and does not

[62] See Chapter 3, Section 3.4.
[63] 'quel nuovo epiciclo, che porta la Luna per lo spazio della quarta sfera, ha bisogno anch'egli di machine, e di girandole per salvar tutte l'apparenze, massimamente che quel terzo moto della terra ne' lati, non può succedere senza, che la terra cammini obliquamente', in Tassoni, *Pensieri*, IV, 25 p. 517.

> keep the same route which the Earth keeps in making the great circle while it does keep it in making the small twenty-four-hour circle.[64]

The conclusion of the *quesito* in the 1627 edition of the *Pensieri diversi* recalls a core principle of Tassoni's natural philosophy: the parts of a body to which motion is applied must themselves move independently; in other words, if the Earth moves, every bit of the Earth should intrinsically move as well. Experience, however, invalidates this assumption, which according to Tassoni's thinking confirms the immobility of the Earth: 'there is no part of the Earth that moves by itself; on the contrary, to stop things that move, a piece of earth is placed on top of them'.[65]

These objections to the new cosmological model, presented about 10 years later than the first version of the *quesito*, seem to argue in favour of Tassoni's significant involvement in defending traditional knowledge. The following section presents Tassoni's *quesito* opposing the motion of the Earth in its various facets. This presentation will provide answers as to why and to what extent Tassoni was so keen to defend the ancient theory.

Tassoni's opposition to Copernicanism: Arguments and sources

The hypothesis of the motion of the Earth entailed a range of consequences that were unacceptable within the realms of traditional scientific knowledge. Already present in Aristotle and Ptolemy's works, the arguments supporting geocentrism found new expositions in the texts of modern thinkers and retained their success for centuries, becoming widely employed in the literature against Galileo.

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[64] 'Aggiungo, che quanto alla Luna, s'ella si gira insieme con la terra nell'istesso Epiciclo, come vuole il Cupernico, e la terra in dodici mesi fa il suo corso maggiore, passando sotto i dodici segni del Zodiaco; io non intendo come la Luna, che non si parte mai dalla terra, passi per tutti per li medesimi segni in trenta giorni soli, e non serbi il medesimo tenore, che serba la terra nel fare il giro grande; mentre il serba nel fare il giro piccolo delle ventiquattro ore', in Tassoni, *Pensieri*, IV, p. 517.

[65] 'non si trova parte alcuna di terra, che da se stessa di moto alcuno si muova; anzi per fermar le cose che si muovono, si mette lor sopra un pezzo di terra', in Tassoni, *Pensieri*, IV, p. 518.

The reason for concern with regard to the new cosmological order was, in fact, not simply due to a wish to adhere to the Aristotelian paradigm or to religious beliefs; rather, it was because, apparently, it was supported by evidence and by certain physical and mathematical theories that were widely accepted.[66] By analysing Tassoni's *quesito*, we will encounter some of the arguments against the diurnal motion of the Earth that were most employed, and which serve to reject the new cosmological model.

Certainly, the defence of the immobility of the Earth that Tassoni embraces is no surprise. The *quesito* opposing the motion of the Earth is built using those theories that we are now able to recognise as constitutive of Tassoni's entire system of natural philosophy and representative of his scientific thinking. Therefore, theories already encountered in the previous chapters, along with new theoretical assumptions, are now used to prove the necessity of supporting a geostationary system.

The first simple argument used by Tassoni to reject the motion of the Earth has its roots in the natural principles theorised by the *novatores* of the sixteenth century. By renewing the ancient Pythagorean suggestion of the struggle between two opposite principles and making this representative of reality, we have seen those natural philosophers such as Cardano, Telesio, and Campanella believed heat and cold to be the founding principles of the natural world. In their wake, Tassoni believed the Earth and the heavens to be intrinsically cold and hot, respectively. As has already been seen, everything that is cold cannot move; even those mixed bodies that are able to move because they contain heat become immobile when the heat ceases or the cold becomes excessive, for example, when water freezes. Therefore, attributing motion

[66] In this *quesito*, Tassoni does not mention any sources explicitly; however, his arguments appear to be the most-used means of opposing the motion of the Earth from ancient times to modernity. See, for example, Grant, *Planets, Stars, and Orbs*, pp. 635–73.

to a body that is essentially cold is untenable; in fact, immobility is a natural feature of cold bodies.

In a wider sense, for Tassoni the heliocentric system is also in opposition to the harmony of the universe.[67] For this to occur, bodies are located in the place where they belong in accordance with their nature and for their own preservation. This also means their positioning reflects the best cosmological arrangement for the conservation of the universe. Because terrestrial bodies are cold and celestial bodies are hot, they cannot but be located at a significant distance from each other to avoid corruption. As Tassoni has already explained in the *quesiti* previously discussed, corruption and destruction arise from the opposite features present in bodies. Within a heliocentric scheme, the distance between celestial and terrestrial bodies is not preserved. Therefore, Copernicus was attacked for his support for a system that was contrary to the natural order and disposition of things: 'but Copernicus locates the Sun in the lowest place and the corruptible and dark Earth in the midst of the bright and eternal stars; which is contrary to the order that nature requires'.[68] Moreover, the widely accepted disposition of the planets would be undermined insofar as the location of the Earth above the Moon would imply that the Moon, Venus, and Mercury were all above the Sun and in opposition to the Earth.

Further, Tassoni questions the ability of astronomy as a discipline to predict eclipses. Such predictions are based on the motions of the Moon and the Sun, but if the latter body were stationary, the thinking of the discipline would be undermined.[69] Tassoni, therefore, stresses

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[67] I use the word 'harmony' meaning 'the natural order and disposition of things'. For an insight on the concept of harmony as it was meant within the heliocentric cosmological system, see De Pace, *Galileo Lettore di Copernico*, pp.183−201.
[68] 'ma il Cupernico mette nell'infimo luogo il Sole; e la terra corruttibile, e buia, in mezzo alle stelle luminose, ed eterne; il che è contra l'ordine che la natura richiede', in Tassoni, *Pensieri*, IV, 25, p. 512.
[69] Tassoni, *Pensieri*, IV, 25, pp. 512−13.

that the new system would challenge astronomy itself for its ability to predict natural phenomena.

Quotations from the Scriptures are also frequently used to oppose the new system.[70] Tassoni mentions the most well-known of these, which recurred frequently in texts that were written to oppose heliocentrism: Ecclesiastes (1: 5, 6) and the famous episode reported in Joshua (10: 13). Both the excerpts from Ecclesiastes (1: 5, 6) and the celebrated episode reported in Joshua (10: 13) present the sun as a movable body. In Ecclesiastes, the story is set in the context of the reflections of a wise Israelite man who claims the futility of a human life in which everything seems to be a succession of vain generations who achieve nothing without God's guidance, 'the Earth stands forever and ever, the Sun rises and sets, hastens to the place from where it will rise again. The wind blows to south, then turns to north, rotates and turns and turning around it [the wind] returns',[71] but, essentially, 'there is nothing new under the Sun' (*nihil sub sole novum*): nothing seems to have a sense of purpose unless by means of faith man concentrates on the firmament, the place where God resides and which is confirmation that this apparently absurd life actually has a meaning. However, when used in defence of the immobility of the Earth, the text is decontextualised insofar as its role is simply to show that an authoritative book such as the Scriptures confirms the absurdity of the heliocentric theory that sets the Earth in motion and fixes the Sun at the centre of the universe.

In addition, Tassoni refers to the miracle granted to Joshua. Joshua asked God to make the Sun stand still so that he would have enough daylight to defeat the Amorites: 'The sun

[70] The first to employ biblical excerpts to show the incompatibility between Copernicanism and the Christian religion was Lodovico delle Colombe, who in his *Contro il moto della Terra* gathered together many biblical references to oppose the motion of the Earth, including the two texts that Tassoni also refers to. Galileo himself reacted to the argument in Joshua in response to the Grand Duchess Christina of Lorraine. The argument was also employed by Tommaso Caccini. Rather than seeing the argument as supporting the unacceptability of Copernicanism, Galileo used it in support of the Copernican view; in fact, he stressed that God's command was seen in the motion of the Sun around its own axis. See Camerota, *Galileo Galilei*, p. 271 and Camerota, Giudice, Ricciardo, *Galileo ritrovato*, pp. 35–37.

[71] '*Terra autem in aeternum stat. Oritur sol, et occidit et ad locum suum revertitur, ibique renascens girat per meridiem et flectitur ad aquilonem. Lustrans universa in circuitu pergit*', in Tassoni *Pensieri*, IV, 25, p. 513.

stopped /and the moon stood still /until the people took revenge on their enemies' and 'the Sun stood still at the centre of the heavens and did not run to set almost a whole day'.[72] How could this be considered a miracle if the Sun was stationary as Copernicus declared?

According to these references, supporting Copernicanism would imply going against the Scriptures and, consequently, opposing the authority of religion. Furthermore, the positioning of the Earth among other stars and, thus, the invalidation of the substantial difference between the celestial and inferior realms, suggested the absurd assumption that the stars were nothing but many other worlds. In this sense, considering the similarity between the Moon and the Earth, it could even be supposed the Moon was inhabited, something that was firmly rejected by Tassoni. These arguments form a significant part of Tassoni's criticism of the new system; however, most of the arguments employed by Tassoni in support of the immobility of the Earth are based on physical and mathematical reasoning. They are principally grounded in Aristotle's *On the Heavens* (and in its commentaries) and in Ptolemy's *Almagestum*, and had been widely used by the supporters of the immobility of the Earth since the Middle Ages.

In particular, arguments can be found in Tassoni's *quesito* that seem to be based on the Aristotelian theory of projectile motion. According to Aristotle, an arrow fired upward falls down at the foot of the archer, proving that the Earth is stationary; otherwise, the point at which it fell would be different, considering the archer was standing on the rotating Earth. This argument was largely employed in the literature opposing the Copernican thesis and was developed by Brahe, who reinforced it by discussing the theme from various angles. These can be summarised as follows:[73]

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[72] '*Expectavit itaque sol, et luna stetit, donec ulcisceretur se gens de hostibus suis'; 'Stetit itaque sol in medio coeli, et non festinavit occumbere spatio unius diei; nec fuit ante, vel postea tamlonga dies*', in Tassoni, *Pensieri*, IV, 25, p. 513.
[73] See Tycho Brahe, *Epistolae astronomicae*, 6, pp. 197–220, in Tycho Brahe, *Opera omnia*, 15 vols., ed. by John Louis Emil Dreyer (Copenhagen: Libraria Gyldendaliana, 1913–29).

- difference between two falling bodies: one dropped from a tower and another dropped from a ship's mast when the ship is in motion
- shots fired by artillery (vertically upward)
- shots fired eastward, westward, southward, or northward

The first two examples presented by Tassoni, which recall Brahe's ideas, concern falling bodies.[74] A stone, that is dropped from a tower, lands beneath it, whereas if the Earth revolved on its axis the stone should fall to the east of the tower. This assumption seemed to be confirmed by considering that a lead ball dropped from a ship's mast when the ship is in motion only falls beneath the mast when the ship is not moving. Furthermore, a projectile fired straight upward should fall back to the west and not along the same vertical axis as, conversely, it actually does. According to Brahe, this evidence proves the Earth is stationary. A similar form of reasoning is presented by Tassoni, who in his *quesito* refers to the fact that the diurnal motion of the Earth should have an effect on the motion of an arrow fired by an archer and on the way heavy bodies fall. Tassoni reports that if the Earth revolved on its axis, the arrow should fall to the west, a long way away from the archer. In addition, a heavy body dropped from the top of a tall structure such as a tower or antenna should fall to the west of where it was dropped. However, both the arrow and the heavy body land beneath the point from which they were thrown, proving the Earth is stationary.

Reminiscent of the ancient discussion on these matters, Tassoni also stresses that counter-arguments considering the inclination of the arrow, the role played by the air in support of a supposed revolving motion of the arrow, or the motion undertaken by the falling body in conformity with the predominant body, which is the Earth—arguments that are aimed at equalising the motion of the object with the Earth's rotation to justify where it falls—must be

[74] Tassoni, *Pensieri*, IV, 25, pp. 513−14.

rejected.[75] In the case of the arrow, it must be considered that when violently thrown up by the archer, it ploughs through the air; thus, at the very moment the arrow rises, it cannot be involved in any revolving motion. Because in the meantime the archer has moved away, this means the arrow cannot reach the archer anyway. In addition, a more general argument suggests it is not possible for mixed bodies, that is, both the arrow and the heavy body in the examples, to move with two different motions with the same velocity of the Earth, which is a simple body; consequently, the points at which the objects fall could not be what they are, assuming the Earth does not rotate.

According to Brahe, if the Earth had motion, and if the motion of objects launched in a specific direction were considered, specifically, the trajectory of a cannon shot fired westward should be longer than the trajectory of a shot fired eastward. Similarly, Tassoni considers that an arrow fired westward should plough through the air in a wider arc than if it was launched eastward, because of the great speed of the Earth's movement in the opposite direction: 'If the Earth moved with such speed as the critics [of the immobility of the Earth] suppose, that bow which shoots 300 steps towards the east would shoot three thousand towards the west with respect to the Earth which turns very quickly towards the east when the arrow splits the air towards the west'.[76]

However, another argument found in Brahe and reported by Tassoni concerns the archer once again. Tassoni points out that the eastward motion of the Earth would imply that an archer, aiming northward or southward, could make the shot only if he were able to position the arrow accurately towards the east, the direction in which the target would move if it were complying with the Earth's motion:

[75] Tassoni, *Pensieri*, IV, 25, p. 514.
[76] 'movendosi la terra con tanta velocità con quanta suppongono gli avversari, quell'arco che tira 300 passi verso levante ne tirerà tremila verso ponente per rispetto della terra che si gira velocissimamente verso levante mentre la saetta va fendendo l'aria verso ponente', in Tassoni, *Pensieri*, IV, 25, p. 516.

> Given the supposed motion of the Earth, if he [the archer] places the target at the north or south in a stable place, he will never be able to hit it if he does not take advantage towards the east, because while the arrow ploughs through the air and, flying, passes straight to where it was aimed, the target, stolen by the course of the Earth, moves forward towards the east, and does not wait for the blow of the arrow.[77]

It should also be mentioned that if the Earth rotated, its motion could be used to the advantage of artillery operations. In fact, a shot fired westward would reach its target with greater violence. As Tassoni explains, this would happen because the Earth would influence what happened at the target by its eastward motion and, consequently, the shot would be made and the target reached with the highest *impetus*. In the specific case of artillery, Tassoni says: 'this would be an excellent warning to adjust the guns attacking besieged walls, putting them [the guns] always on that side that faces east, because the balls meeting the walls from afar, [the guns] would make a greater impact than from the west [where they would be] very close'.[78]

Furthermore, Tassoni opposes the followers of Copernicus by reflecting on the problems the motion of the Earth would cause for sailors: considering that both the air and the water would follow the eastward motion of the Earth, sailing would be impossible for those who moved westward, because the wind would be always contrary to their direction. Additionally, Tassoni rejects the eastward motion of the Earth by noting that if some clods of earth are thrown upward, they do not fall down again following the Earth's motion to the east, as would be expected, but fall back down in different directions: 'we see that [when they fall] the balls now

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[77] 'dato il moto che si suppone alla terra, s'egli metterà il segno a tramontana o a mezzogiorno in luogo stabile, non vi potrà mai coglier dentro, se non tira a vantaggio verso oriente, percioché mentre la saetta fende nell'aria e volando passa a diritto dove fu presa la mira, il segno, rapito dal corso della terra, trascorre avanti verso oriente, e non aspetta il colpo della saetta', in Tassoni, *Pensieri*, IV, 25, p. 516.
[78] 'questo sarebbe un ottimo avvertimento per aggiustar l'artiglierie contra le mura assediate, mettendole sempre da quella parte che riguarda a levante, percioché da lontano, venendo le mura a incontrar le palle, farebbono maggior colpo che da ponente molto vicine', in Tassoni, *Pensieri*, IV, 25, p. 516.

bend to the north, now to the west, now to the south without following the course of the Earth to the east. Therefore, it is not true that the Earth runs or moves by turning towards the east'.[79]

Another argument used by Tassoni against the diurnal motion of the Earth is based on the observation of a celestial body that is stationary in the sky, for example, the fixed stars of the firmament or, in the Copernican perspective, the Sun itself. Tassoni claims that if the motion of the Earth were accepted, the observation of a fixed star from the bottom of a well, or of the Sun through a window from the centre of a room, would attest that the star/Sun went out of sight of the observer in a very short time; however, this does not happen, so once again there is confirmation of the immobility of the Earth. Moreover, as far as the observation of a fixed star is concerned, Tassoni clarifies that an objection could be presented by those who believe in the motion of the eighth sphere. Essentially, the movement of the star out of sight seems also to occur if the Earth is considered stationary, precisely because of the motion of the firmament. However, Tassoni invalidates this by explaining that viewing an object is done by angles, and that the angle formed between the observer and the star covers a space that enables the object to remain in sight for longer than if the observer, rather than that which is being observed, moves:

> the argument does not work in the opposite direction […] for from the heavens to the eye of he who is in the well a pyramid is formed, which with its base encompasses the star, and with its point ends in the eye: so that if the diameter of the said base could be measured, it would be, for example, six hundred miles whereas the diameter of the point at the entrance to the well would be six palms. But from the movement of the heavens to that of the Earth, as far as the disappearance of the star is concerned, there is that difference which is between six palms and six hundred miles.[80]

[79] 'vedrassi che le palle ora piegano a tramontana, ora a ponente, or all'austro senza secondare il corso della terra a levante. Adunque non è vero che la terra corra né si muova girando verso oriente', in Tassoni, *Pensieri*, IV, 25, p. 517.

[80] 'l'argomento non cammina al contrario, perciochè […] dal cielo all'occhio di colui che è nel pozzo si forma una piramide, che con la base circonda la stella, e con la punta finisce nell'occhio: onde se il diametro di detta base potesse misurarsi, sarebbe per esempio secento miglia, dove il diametro della puta all'entrata del pozzo sarà sei palmi. Però dal movimento del Cielo a quello della terra, quanto allo sparire della stella, vi corre quella differenza, che è tra sei palmi, e secento miglia', in Tassoni, *Pensieri*, IV, 25, p. 515.

Additional arguments presented by Tassoni as physical and mathematical evidence opposing the motion of the Earth recall Ptolemaic suggestions. Once again, the theoretical nucleus is based on the inconsistencies between what is actually observed and what would be expected to happen if the Copernican theory were tenable. For example, according to Ptolemy, the diurnal motion of the Earth would affect the flight of birds; indeed, they should move westward because of the rotation of the Earth. In this respect, Tassoni refers to the effects the rotation would have not only on the birds' flight, but also on the natural phenomena, and on the motion of the terrestrial animals. Tassoni points out that although a bird cannot fly around the Earth in twenty-four hours, we can clearly see that its speed exceeds the speed of the motion attributed to the Earth, as attested by the simple fact that when we walk—following the motion of the Earth—a bird in flight easily reaches and then overtakes us.[81]

Moreover, if the Earth rotated as fast as the Copernicans declared, its motion should also have visible effects on the motion of the clouds. They should appear to move faster and faster while moving in the opposite direction to the Earth or, if hailstones are considered, they should be distributed over a larger area if the clouds were moving eastward in the same direction as the Earth's motion. In addition, the terrestrial animals should be affected by the Earth's rotation, because they are mainly composed of the element earth. In this sense, their eastward motion should be smooth and fast, whereas, conversely, they should move westward slowly and hesitantly, or scarcely at all, and with reluctance.[82]

The knowledge derived from the senses also argues in favour of the immobility of the Earth because a circular motion causes vertigo, nausea, and even death. If we were to be continuously influenced by circular motion it would seriously affect us; therefore, the Earth must be immobile. As far as Tassoni is concerned, he also excludes the notion that the Earth

[81] Tassoni, *Pensieri*, IV, 25, p. 515.
[82] Tassoni, *Pensieri*, IV, 25, p. 516.

rotates without us perceiving its motion, although we do perceive the motion of other elements and mixed bodies. He says: ‘it is not realistic that the Earth, more perceptible [to our senses] than all the other elements, were in motion with the speed that Copernicus and his followers say, without our senses noticing it’.[83]

These are the arguments used by Tassoni to oppose the idea that is inherent in heliocentrism: the mobility of the Earth. They confirm that even if since 1610 Copernicanism had started to spread more than ever due to Galileo’s observations, there was still widespread reluctance to accept this viewpoint.

Tassoni illustrates the various issues that opposed the acceptance of heliocentrism extremely well. He had a special talent for presenting a rich picture of the combined resistance, without aligning himself with any one particular group of thinkers. Tassoni himself was an eclectic thinker, and his *quesiti* show that adherence to Aristotelian physics, unquestioned for so long, was beginning to waver; not only were those advocates of the ‘new science’ becoming disenchanted, but also those representatives of a worldview that had strongly supported Aristotelian–Ptolemaic theories. Conversely, with his specific *quesito* opposing the motion of the Earth, Tassoni, by means of his own adherence to the Aristotelian dynamics of the celestial body, emphasised the difficulty of understanding the real meaning of the new discoveries emerging at the time. To understand the new discoveries fully, a further step was needed. It was necessary to adopt a new epistemological tenet: the realisation that only one physics existed and, thus, that this new homogeneous physics needed to be applied to both the celestial and terrestrial regions. Indeed, the discoveries of the early modern era are revolutionary insofar as they changed the epistemological paradigm through which they were interpreted. What we can recognise today as representative of the Scientific Revolution was the outcome of a gradual

[83] ‘non è verisimile che la terra, più sensibile di tutti gli altri elementi, se si muovesse con la velocità, che dicono il Cupernico, e suoi seguaci, il senso nostro non se n’havesse d’accorgere’, in Tassoni, *Pensieri*, IV, 25, p. 513.

process of change that resulted in the geometrisation of physics. In the period under analysis, we are just at the beginning of this evolution; in this sense, Tassoni is representative of the early modern era, a period in which traditional theories and new suggestions were intersecting. Tassoni played a role in producing and disseminating the resulting intersections, as he synthesised opinions from natural philosophers, astronomers, members of the clergy and even poets to construct his own opinion. Not only does Tassoni thus erase the separation between literature and science ,[84] but he reaches an unusually wide public because of the format of the *Pensieri diversi*: a sort of encyclopedia where each topic can be quickly found and read and where there are references to other sources for supplementary information.[85] Moreover, Tassoni's interdisciplinary approach and address to a broader public were, to some degree, clearly successful since traces of his ideas are found in Vincenzo Coronelli's encyclopaedia, and in Antonio Rocco's text against Galileo.[86]

[84] For a different idea about the relation between science and literature see Bellini, especially pp.31–40.
[85] See Chapter 2, especially section 2.1.
[86] As far as Vincenzo Coronelli (1650–1718) is concerned it should be mentioned his *Biblioteca universale sacro-profana* (1701–1707), one of the the first universal encyclopedias in a European vernacular language, with entries arranged alphabetically. It was conceived to be in 45 volumes, but only 7 volumes appeared, reaching the letter C whithin which the entry 'calore' (heat) includes Tassoni's conception of heat, reporting some of his *quesiti*. See Vincenzo Coronelli, *Biblioteca universale sacro-profana, antico-moderna, in cui si spiega con ordine alfabetico ogni voce, anco straniera, che può avere significato nel nostro idioma italiano, appartenente a' qualunque materia* (Venice: Antonio Tivani, 1701-1706), vol. 6, pp. 436–42. For information about Tassoni's influence on Antonio Rocco (1586–1652), see Olschki, *Bildung und Wissenschaft*, p. 298. Finally, Tassoni's cosmological ideas was even used, despite deprived of the scientific value he wanted to demonstrate, in our contemporary literature in so far as they were borrowed recently by Umberto Eco in one of his historical fiction novel: *L'isola del giorno prima*. The novel is set in the 17th century and the central character is Roberto de la Grive. Roberto is stranded on a ship, following a shipwreck. In the ship he meets Kaspar, a Jesuit with whom he begins to converse. During their dialogue rich information about the discoveries of Galileo, the Copernican and Ptolemaic theory emerge. More specifically, the cosmological idea found in Tassoni *quesito* against the motion of the Earth are expressed by Kaspar. See Umberto Eco, *L'isola del giorno prima* (Milan: Bompiani, 2003). However, the full breadth of the audience whom Tassoni reached still needs to be investigated.

Tassoni's argument in relation to Galileo's Dialogo

In 1632, despite the strong opposition, Galileo's *Dialogo sopra i due massimi sistemi del mondo* was published.[87] The content of the book is well known: it presents the two chief world systems, geocentrism and heliocentrism, through the voice of three characters, Simplicio, Sagredo, and Salviati. The setting for the dialogue is Giovanni Francesco Sagredo's palace in Venice, where over a span of four days, which also represent the temporal division of the dialogue, the protagonists discuss many arguments linked to the early seventeenth-century debate about the two opposing cosmological systems.

If the preface addressed to the reader (*Al discreto lettore*) formally complies with the request to present the new cosmological theory hypothetically (*ex suppositione*) and not deliberately (*ex professo*), the text itself does not hide the real intention of its author to promote the heliocentric thesis and to indicate his support for the physical reality of the new planetary arrangement. In fact, in providing a response to the arguments against Copernicanism, Galileo aimed to silence those who supported the Aristotelian–Ptolemaic system. To this end, a wide range of cosmological topics are discussed, for example, the difference between the celestial and terrestrial regions, circular and rectilinear motion, planetary motion, the Aristotelian theory of the elements, the creation and corruption of bodies, the appearance of new stars, sunspots, the Moon's surface, the diurnal and annual motion of the Earth, tides, etc.

The discussion of these topics often tacitly implies those arguments that were usually adopted by Galileo's intellectual interlocutors in opposition to his position. Galileo always

[87] The information about Galileo's *Dialogo* is from the critical edition and commentary by Besomi and Helbing: Ottavio Besomi e Mario Helbing (eds.), *Galileo Galilei. Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano* (Padua: Antenore, 1998). For the English edition of Galileo's *Dialogo* I suggest: Galileo Galilei, *Dialogue Concerning the Two Chief World Systems, Ptolemaic and Copernican*, transl. by Stillman Drake (Berkeley: University of California press, 1967).

showed a great interest in the criticism of his own theories. This can be attested by focusing on his works: they are explicitly or implicitly conceived of as answers to his polemical interlocutors such as Lodovico delle Colombe, Scipione Chiaramonti, Baldassare Capra, and Orazio Grassi. It is precisely this aspect that motivates my attempt to investigate the intellectual connection between Galileo and Tassoni, and to shed a new light on their relationship.

The presence of Tassoni's *Pensieri diversi* in Galileo's library contributes partially to substantiating the hypothesis that their intellectual relationship might have been stronger than we have been led to expect, and that Tassoni's involvement in the cosmological debates of the time might have been considered much more relevant by his contemporaries than later historiography indicates. As we have seen, this has mostly ignored Tassoni's contribution to scientific knowledge. However, in all likelihood, Galileo's interest in Tassoni's book was motivated by the scientific ideas proposed in it and particularly by the presence of the *quesito* that opposed the motion of the Earth.

The most important evidence in this respect consists of one of Tassoni's arguments opposing the motion of the Earth, which I presented in the previous section (Tassoni's opposition to Copernicanism: Arguments and sources), namely, the invalidation of the diurnal motion of the Earth through the 'argomento del pozzo' (subject of the well). It is worth repeating that the theoretical core of this argument lies in the gap between what actually happens and what we think is happening, that is, if we accept the Earth's rotation, when a fixed star is observed from the bottom of a well. Tassoni claims that if the Earth were not stationary, the stars would move out of the observer's sight in a short while, and because this does not happen, the immobility of the Earth is confirmed. Interestingly, this same argument is also found in Galileo's *Dialogo*:[88]

[88] For a more accurate comparision of this argument in Tassoni's and Galileo's books, both authors' texts are given in the original language and in English in the main text here.

Tassoni, *Pensieri*	Galileo, *Dialogo*
Ora se noi da stare in un pozzo miriamo di notte qual si voglia stella del firmamento, dato, che sia vero, che la terra in ventiquattro hore si giri tutta; quella stella a pena veduta sparirà in un istante, percioché noi non la veggiamo, se non per lo spazio di sei palmi di apertura di terra, che in un istante si gira dall'aspetto della stella e la cuopre. Ma ciò non avviene; anzi chi farà tale esperienza, troverà, che la stella tarda un pezzetto a sparire; adunque non è vero che la terra si muova, come gli avversari suppongono (Now if we, from a well, look with wonder at any star in the firmament at night, and it is true that in twenty-four hours the whole Earth turns, that star will disappear in an instant after barely having been seen, because we do not see it except for the space of six palms of the Earth's opening, which in an instant turns from the appearance of the star and covers it. But this does not happen; on the contrary, whoever will have such an experience will find that the star takes a little while to disappear; therefore, it is not true that the Earth moves, as critics suggest).[89]	quando il moto diurno fusse della Terra, dovrebbe esser tanto veloce, che uno costituito nel fondo di un pozzo non potrebbe se non per un momento di tempo vedere una stella che gli fusse sopra 'l vertice, non la potendo egli vedere se non quel brevissimo tempo nel quale passa 2 o 3 braccia dalla circonferenza della Terra, chè tanta sarà la larghezza del pozzo: tutta via si vede per esperienza che il passaggio apparente di tale stella, nel traversare il pozzo, consuma assai lungo tempo; argomento necessario che la bocca del pozzo non si muove altramente con quella furia che converrebbe alla diurna conversione, e, per conseguenza, che la Terra è immobile (If the diurnal motion was of the Earth, it would have to be so fast that a man standing at the bottom of a well could not see except for a moment a star above, because he could not see it except for the very short time in which it passes 2 or 3 braccia from the circumference of the Earth, which is the width of the well: however, one sees from experience that the apparent passage of such a star, in crossing the well, takes a very long time; an argument necessary [to prove] that the mouth of the well does not move other than with that haste which would be appropriate to the diurnal motion, and, consequently, that the Earth is immobile).[90]

Curiously, this topic does not appear in the published text of the *Dialogo*, but is included in three original sheets of paper—along with other supplements containing corrections,

[89] Tassoni, *Pensieri*, IV, 25, p. 514.
[90] Galileo, *Dialogo*, III, 130–53, pp. 360–61.

additions, and annotations—handwritten by Galileo and inserted in the *editio princeps* (1632), which is preserved in the library of the Seminario di Padova.[91]

In the *Dialogo*, the argument of the observation of a fixed star from the bottom of a well is introduced by Sagredo and discussed by the protagonists on the third day. More precisely, the additional argument in relation to the diurnal motion is presented as a digression in the debate about the annual motion of the Earth. The diurnal motion of the Earth had, in fact, been discussed on the second day.

After examining the widely known anti-Copernican themes and rejecting them through 'evident and, therefore, necessarily conclusive observations',[92] the interlocutors present as a corollary the fact that the central location of the Earth is untenable and they seem convinced that both annual and diurnal motion must be ascribed to the Earth.[93] However, the intellectuals' agreement in relation to the argument supporting the immobility of the Earth, although apparently simple and weak, allows for digression and further clarification.

Sagredo presents two arguments opposing the diurnal motion of the Earth, declaring that they came from 'people of great knowledge'.[94] One of them, the 'argomento del pozzo', is highly regarded by the interlocutors. Simplicio, who appears particularly impressed, but also confused by this argument, also tackles it from the traditional point of view and, therefore, considers the Earth to be stationary and the sphere of the fixed stars to be moving: 'if the argument were correct, that immense speed which should be seen in the star if the Earth moved

[91] A comprehensive study of Galileo's original additions to this edition of the *Dialogo* was conducted by Antonio Favaro, and I refer to this for a detailed overview of Galileo's interventions in the text: Antonio Favaro, 'Le aggiunte autografe di Galileo al Dialogo sopra i due massimi sistemi nell'esemplare posseduto dalla Biblioteca del Seminario di Padova', *Memorie della R. Accademia di scienze, lettere ed arti di Modena*, 19 (1880), pp. 245–75. Galileo, *Dialogo*, pp. 697–98. The additional notes appear in later printed copies of the *Dialogo*, including Ottavio Besomi and Mario Helbing's critical edition and commentary on Galileo's work. They have inserted the text (III 130–53 1) exactly at the point indicated by Galileo himself in his notes. Besomi and Helbing, too, consider Alessandro Tassoni as the more likely original source of this argument. Besomi and Helbing, pp. 697−98.

[92] 'evidentissime, e perciò necessariamente concludenti, osservazioni', in Galileo, *Dialogo*, p. 351.

[93] Galileo, *Dialogo*, pp. 350−59.

[94] 'persone di gran letteratura', in Galileo, *Dialogo*, p. 360.

should still be discerned, indeed much more, in the same [star] when the motion was its own, since that speed would have to be many thousands of times faster in the star than in the Earth'.[95] As we have seen, the same argument was introduced by Tassoni, who refuted it by employing reasoning inspired by the intromission theory of vision.[96]

Without analysing the development of the debate more in depth, an answer to the 'argomento del pozzo' can be provided: for a correct understanding of motion, Salviati refers both to the concept of inertia and to the relationship between the well's depth and the portion of the sky visible to human sight. More precisely, Salviati states that within the same inertial frame of reference it is impossible to define what is in motion and what is stationary; therefore, the argument presented would not invalidate the diurnal motion of the Earth for an observer located in the same inertial space of reference (the Earth):

> What you say, Mr. Simplicio, is true when the object you see moves while you are standing still observing it; but if you are in the well when the well and you together are carried along by the terrestrial motion, do you not see that neither in an hour nor in a thousand nor in eternity the mouth of the well will surpass you? What happens to you in that case, whether the Earth moves or not, cannot be recognized in the mouth of the well, but [only] with respect to another separate object which does not participate in the same condition, I mean of motion or of stillness.[97]

In addition, Salviati stressed that the length of time available for observation and the portion of the sky visible to the observer would depend on the position of the latter with respect to the top of the well rather than to the width of the well; indeed, the deeper the well, the smaller the portion of sky visible and the shorter the time to observe the star in that portion of the sky:

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[95] 'se il discorso procedesse rettamente, quella immense rapidità di corso che si dovrebbe scorger nella stella quando il moto fusse della Terra, si dovrebbe ancora, anzi molto più, scorger nella medesima quando il moto fusse suo, dovendo esser molte migliaia di volte più veloce nella stella che nella Terra', in Galileo, *Dialogo*, p. 362.

[96] For an account of this theory, and of the theories of vision in general, see Daniele Calisi, *Luce ed ombra nella rappresentazione. Rilettura storica e sperimentazioni idiomatiche* (Ariccia: Aracne, 2015).

[97] 'Questo che voi dite, signor Simplicio mio, è vero quando l'oggetto veduto si muove stando voi fermo a osservarlo; ma se voi sarete nel pozzo quando il pozzo e voi insieme siate portati dalla terrestre conversione, non vedete voi che né in un'ora né in mille né in eterno sarete trapassato dalla bocca del pozzo? Quello che in tal caso operi in voi il muoversi o non muoversi la Terra, non può riconoscersi nella bocca del pozzo, ma in altro oggetto separato e che non partecipi della medesima condizione, dico di moto o di quiete', in Galileo, *Dialogo*, p. 363.

> It is not, Mr. Simplicio, the width of the well that measures the length of time of the appearance of the star, because then you would see it perpetually, since perpetually the mouth of the well allows the passage of your sight; but this measure must be taken from the amount of the motionless heavens that remains visible to you through the opening of the well.[98]

These two brief excerpts also attest to the introduction of new concepts for the understanding of the world that would be fundamental for the later achievements in the field of physics; Galilean relativity is a case in point. However, this is another piece of the history of modern science and is outside the scope of my research.

The aim of this section was to highlight the intellectual relationship between Tassoni and Galileo. The argument of a man in a well who observes the sky, which is found both in Tassoni's *Pensieri diversi* and in Galileo's *Dialogo*, served to reinforce the suggestion of a mutual interest between the two erudite men. This picture, however, also raises a new hypothesis about the edition of the *Pensieri diversi* owned by Galileo, to which I devote the following and concluding section of this chapter (A note about the edition of Tassoni's *Pensieri diversi* owned by Galileo).

A note about the edition of Tassoni's Pensieri diversi owned by Galileo

In 1886, Antonio Favaro meticulously attempted to reconstruct Galileo's library.[99] Using the inheritance of Galileo's son, Vincenzo Galileo, the inventory of books found in the house of Sestilia Bocchineri (Galileo's daughter-in-law), Galileo's collection of manuscripts, published works, and correspondence, and an inheritance document belonging to Galileo's pupil, Vincenzo Viviani, Favaro compiled a catalogue of 521 books organised into 29 different

[98] 'Non è, signor Simplicio, la larghezza del pozzo quella che misura il tempo dell'apparizion della stella, perché cosí la vedreste perpetuamente, essendo che perpetuamente la bocca del pozzo dà il transito alla vostra vista; ma tal misura si deve prendere dalla quantità del cielo immobile, che per l'apertura del pozzo vi resta visibile', in Galileo, *Dialogo*, p. 364.
[99] Antonio Favaro, 'La libreria di Galileo Galilei, descritta ed illustrata', *Bullettino di bibliografia e storia delle scienze matematiche e fisiche*, 19 (1886), 219–93.

sections reflecting the main subjects of interest. This list serves as a basis for new investigations into Galileo's library, and is still subject to updating and revisions.

Favaro himself published two appendices of additional information,[100] and his overall contribution to the reconstruction of Galileo's library is still the most consulted and reliable source of knowledge for scholars who wish to attempt to continue the work, or simply to include information about the books owned by Galileo in their texts.[101] Post-Favaro Galilean scholarship has been able to enrich the original list with precious new details.[102] The most recent contribution was published in 2015 by Crystal Hall, whose research not only allowed her to suggest amendments but also to increase the number of books in Galileo's collection to 674.[103] Hall, who examined the current documents providing information about Galileo's library, also shed light on the intrinsic challenges of such an attempt to provide a complete list of Galileo's books. This had already been acknowledged by Favaro, and remains an aim that it will always be necessary to revisit. As Crystal Hall notes, 'The collection of books to which Galileo might have had access then becomes a mosaic assembled from numerous sources, ones that are likely to increase as research continues, leaving the project dynamic from its outset'.[104]

In this sense, Tassoni's book can be considered to be a small tessera of a mosaic that is still subject to change. Already present in Favaro's list, the edition of Tassoni's *Pensieri diversi*

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[100] Antonio Favaro, 'Appendice prima alla libreria di Galileo Galilei', *Bullettino di bibliografia e storia delle scienze matematiche e fisiche*, 20 (1887), 372–76; and Antonio Favaro, 'Serie undecima di scampoli galileiani. LXXIX, Appendice seconda alla Libreria di Galileo', in *Atti e memorie della R. Accademia di scienze, lettere ed arti in Padova*, 12 (1896), 44–50.
[101] Pier Luigi Pizzamiglio, 'Le biblioteche di Copernico e Galileo e il ruolo della stampa nella nascita della scienza moderna', in *Galileo e Copernico. Alle origini del pensiero scientifico moderno*, ed. by Carlo Vinti (Perugia: Porziuncola, 1992), pp. 115–40; and Maurizio Torrini, 'La biblioteca di Galileo e dei galileiani', *Intersezioni*, 21 (2001), 545–58; see also Elisabetta Bonucci et al. (eds.), *Galileo e l'universo dei suoi libri. Catalogo della mostra tenuta alla Biblioteca Nazionale di Firenze, 5 dicembre 2008–28 febbraio 2009* (Florence: Vallecchi, 2008).
[102] Michele Camerota, 'La biblioteca di Galileo. Alcune integrazioni e aggiunte desunte dal carteggio', in *Biblioteche filosofiche e private in età moderna e contemporanea*, ed. by Francesca Maria Crasta (Florence: Le lettere, 2010), pp. 81–95.
[103] Crystal Hall, 'Galileo's Library Reconsidered', *Galilæana*: *Journal of Galilean Studies* 12 (2015), 29–82. See also Crystal Hall, *Galileo's Reading* (Cambridge: Cambridge University Press, 2013).
[104] Hall, 'Galileo's Library Reconsidered', p. 34.

has not been reconsidered to date. In this section, I will propose a new date for the edition owned by Galileo.

In the list provided by Favaro, we read 'De pensieri diversi di Alessandro Tassoni libri X. In Modena per Giuliano Cassi[a]ni 1608'.[105] However, for those who are familiar with Tassoni's work, an inconsistency between the title and the edition of the *Pensieri diversi* to which Favaro refers in his list, is immediately obvious and questions the correctness of this. In actual fact, the source from which Favaro derived the information casts doubts on the reliability of the notes compiled from it. Tassoni's book is mentioned in the inventory of what was inherited by Galileo's son, Vincenzo Galileo junior (1606–1649), and it is currently preserved in the state archive in Florence.[106] The inventory was compiled on 15 June 1649, a month after Vincenzo Galileo's death, and it appears to have been written by the notary Silvestro Pantera in a particularly vague way, which did not help Favaro to accomplish his aim of 'knowing how many and which [Galileo's books] were'.[107] Tassoni's volume is listed simply as 'Pensieri di Tassoni' and appears within a small section that seems to gather together 'different books firstly those in folio'.[108] This information does not help whatsoever in deducing the provenance of the edition of the *Pensieri diversi* owned by Galileo. The note giving the title and the edition of the book must, therefore, have been added by Favaro, and he placed it within a section entitled 'XVII. Critica letteraria' (XVII. Literary criticism). The problem is that Favaro indicated the presence in Galileo's library of a version of Tassoni's *Pensieri diversi* organised into ten books ('libri X' in Favaro's note) that did not even exist until more than a decade later. In fact, as attested by the history of the editions of the *Pensieri diversi* itself, the text that appeared in 1608 was entitled *Parte de' Quesiti del Sig. Alessandro Tassoni dati alla luce da*

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[105] Antonio Favaro, *La libreria di Galileo Galilei, estratto dal Bullettino di bibliografia e di storia delle scienze matematiche e fisiche, tomo 19, maggio-giugno 1886/descritta ed illustrata da Antonio Favaro* (Rome: Tipografia delle Scienze matematiche e fisiche, 1887), p. 57.
[106] See Fondo Notarile Moderno, Protocolli 15676–15685, Silvestro Pantera 1646–50 (MS 3483.3), c. 515*r*.
[107] Hall, 'Galileo's Library Reconsidered', pp. 45–46.
[108] 'Libri diversi et prima libri in foglio', in Pantera, Fondo Notarile Moderno, c. 515*r*.

Giulian Cassiani, e dedicati agli illustrissimi Accademici della Crusca. This version was not divided into different books and probably represented Tassoni's first attempt at investigating the natural philosophical and scientific issues of the time.[109] The division into ten books had not even been conceived by Tassoni at this stage, and certainly not before 1613. We know that in 1613 he was writing a book in which he distinguished between and compared the achievements of the ancients and moderns in different disciplines.[110] However, this text, entitled *Paragone degli ingegni antichi e moderni* (Comparison between the Achievements of the Ancients and the Moderns), was not published in its own right, but had its place as the tenth and last book in a new edition of *Pensieri diversi* that was only published in 1620, this being the first edition to be divided into ten books.[111]

However, other editions precede and follow the one published in 1620. A quick look at the editions of the *Pensieri diversi* will help to justify the proposal to revise Favaro's note in favour of the 1620 edition.[112] The editions of the *Pensieri diversi* that should be taken into account to try and establish the provenance of the edition present in Galileo's library are those

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[109] The correct title of the text published in 1608 had already been indicated in the database of Galileo's library at the Museo Galileo in Florence: (https://opac.museogalileo.it/imss/resource?uri=985057&v=l&dcnr=0).

[110] The source of this information is Tassoni himself, who says: 'My Lord, having heard that he had [said] that you threatened to write against his questions about fire and the heavens if he had published them, he immediately published them in that same week. And, to show you more how much he esteems you while you perhaps thought […] to have kept him oppressed these two past months of March and April; he left all the care of it to me and he himself waited to compose a new book of many chapters on the ancient and modern minds, in order to give you more ample matter to write against him (Il mio padrone sentito ch'egli ebbe che voi minacciavate di scrivere contra i suoi quisiti del fuoco e del cielo se li pubblicava, subito quella settimana stessa li pubblicò. E, per mostrarvi di più quanto egli vi stima mentre voi forse credevate che le risposte dei vostri sogni l'avesser tenuto oppresso questi due mesi passati di marzo e d'aprile; n'ha lasciata tutta la cura a me ed egli stesso ha atteso a comporre un nuovo libro di molti capi sopra gli ingegni antichi e moderni, per darvi più ampia materia di scrivergli contra)', in Tassoni, *La tenda rossa*, p. 187.

[111] Towards the end of 1615, in a letter sent from Rome to Canon Albertino Barisoni, Tassoni pointed out the new division of the volume into ten books: 'Se cotesto signore ha in mano il mio libro, come scrive il Ciotti d'averglielo consegnato, bisogna vedere che sia l'ultima copia meglio corretta ch'io consegnai al signor Gualdi, la qual si conoscerà facilmente perché ha il decimo libro legato con gli latri 9, scritto in lettera minuta di mia mano, e la prima copia l'ha separato, d'altra mano' (*Lettere* I, no. 295, 12 Dec. 1615).

[112] The brief overview I provide here is based on the invaluable contributions offered by Pietro Puliatti, who has published Tassoni's epistolary (1591–1634) and a new edition of the *Pensieri diversi* (1986). Alessandro Tassoni, *Lettere*, I (1591–1619) and II (1620–1634), ed. by Pietro Puliatti (Bari: Laterza, 1978). Alessandro Tassoni, *Pensieri e scritti preparatori*, ed. by Pietro Puliatti (Modena: Panini, 1986).

published in 1608, 1612, 1613, 1620, 1627 and 1636.[113] The title of the 1620 edition reflects Tassoni's additions in terms of content: *Dieci libri di pensieri diversi d'Alessandro Tassoni ne' quali per via di quesiti con nuovi fondamenti, e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere. Aggiundovi nuovamente il decimo libro del paragone de gl'ingegni antichi, moderni, e la confutazione del moto della terra, con altri vari quisiti*. In particular, I am referring to the explicit reference within the title to the *quesito* opposing the motion of the Earth, which we know was written in 1616. This further supports the hypothesis that Galileo actually owned a copy of the 1620 edition, when for the first time the book includes the topic of the motion of the Earth. If this hypothesis is confirmed, Favaro's mistake is not his completion of the title of Tassoni's book annotated by Pantera, but only the date.

In the previous section (Tassoni's argument in relation to Galileo's *Dialogo*), Galileo's interest in Tassoni's book has been mainly attributed to the inclusion of the 'argomento del pozzo'. However, a question naturally arises: is there any evidence that Galileo was aware of Tassoni's argument in relation to the motion of the Earth that could further confirm this date? The answer seems to be in the affirmative.

On 8 March 1625, Cesare Marsili sent a letter to Galileo from Bologna in which he informs his recipient about an opinion that opposes the motion of the Earth, which is supported by Scipione Chiaramonte. In the same letter, Marsili also mentions that a better argument on the same topic, or at least one he finds more comprehensible, is the one supported by Alessandro Tassoni in his *Varietà di pensieri* (Variety of Thoughts):

> Cavaliere Chiaramonte […] made an important admission to me, as to a person who professes [expertise in] mathematics; in which he says that the hypothesis of Copernicus is false because he [Copernicus] is not able to assign a mean place and a mean motion to the planets. For myself, speaking so strictly, I do not know what he means, indeed I hold

[113] See the full title of these editions in the introduction of this thesis.

> it to be a much worse argument than that put forward by Alessandro Tassoni in his book *Varietà di pensieri*. In this regard, if I will be able to have greater news than this (which I will procure), I will immediately give you a part of it.[114]

This excerpt from Marsili's letter is drawn from Galileo's correspondence, edited by Favaro. Where Tassoni's book (*Varietà di pensieri*) is mentioned, Favaro inserted a footnote in which he indicated the edition of Tassoni's volume published in 1613: *Varietà di pensieri d'Alessandro Tassoni divisa in IX parti nelle quali per via di quesiti con nuovi fondamenti e ragioni si trattano le più curiose materie naturali, morali, civili, poetiche, istoriche, e d'altre facoltà, che soglian venire in discorso fra' cavalieri e professori di lettere*. If Favaro's indication was correct, suggesting that Marsili was referring to the copy of the *Pensieri diversi* published in 1613, it should be asked which topic Marsili had in mind. In fact, in the *Varietà di pensieri* published in 1613, Tassoni had already delineated a view of the cosmos as a geocentric structure comprised of the Earth, air and heavens, but a question completely devoted to opposing Copernicanism was not present in this edition. We have seen that Tassoni's argument opposing the motion of the Earth, which was also discussed in the *Dialogo*, appears first in the *quesito* written in 1616. With the above in mind, I believe it can be said that in 1625, despite the fact that Marsili referred to Tassoni's volume as *Varietà di pensieri*, therefore reflecting the old title, he was actually referring to the material added after 1613 and, precisely, the edition that was published in 1620 and that includes the *quesito* devoted to confuting Copernicanism, as the title itself attests.

On the other hand, considering that Galileo could have written the arguments in the original edition of his *Dialogo* (preserved in Padua) close to February 1632 as indicated by

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114 'Il Cav.^{r} Chiaramonte mi ha fatto fare […] una racco confidenza, come a persona che professa le matematiche; nelle quali dice che l'ipotesi del Copernico è falsa, perché non è capace di assegnare il medio luogo e il medio moto ai pianeti. Io per me, parlando così strettamente, non so quello che si voglia dire, anzi lo tengo per un argomento molto peggiore di quello che si faccia Alessandro Tassoni nel suo libro della varietà dei pensieri. In tal proposito se potrò haver notizia maggiore di questo (che procurerò), le ne darò subito parte', in Galileo Galilei, *Le opere di Galileo Galilei* (Florence: Barbera Editore, 1935), p. 258.

Besomi and Helbing,[115] it could also be argued that because a long time had passed before he wrote presumably in reply to Tassoni, Galileo could have been able to obtain the 1627 edition of the *Pensieri diversi*. Needless to say, all other editions of the *Pensieri diversi* must be excluded, for example, the one indicated by Favaro, which after reconsideration, is likely to be the 1620 edition.[116]

[115] Galileo, *Dialogo*, p. 47.
[116] In the absence of any evidence from textual comparison between Tassoni's *Pensieri diversi*—both the editions published in 1620 and in 1627—and Galileo's book, I lean towards the 1620 edition since it was the first to gain attention for Tassoni's argument against the Earth's motion and since it was also the edition that most showcased this topic, including a clear reference to this topic in the title.

CONCLUSION

This thesis has sought to shed some light on the reception and dissemination of scientific topics at the dawn of the Scientific Revolution, by analysing a set of theories found in Alessandro Tassoni's *Pensieri diversi*. In attempting this task, the research has demonstrated that Tassoni was far from being only a poet, famous for *La secchia rapita*; rather, he was a learned man interested in science no less than other major figures who populated the Italian scientific landscape of the seventeenth century. Tassoni took an active part in developing and fuelling the debate about important scientific disputes in his own peculiar way, by crafting a holistic encyclopaedia entitled the *Pensieri diversi* throughout which most of the important scientific topics are scattered.

The structure of this book is not linear, and as we have seen, using it to reconstruct Tassoni's scientific thinking has never been attempted before, most likely because of the difficulties posed by the book's significant structural inconsistencies. This thesis aimed to tackle the problem, and systemised those *quesiti* that are relevant for building Tassoni's scientific position into a more coherent and consistent narrative.

The reaction to the scientific discoveries of erudite men, who were specialists in the field of mathematics and astronomy or who had a keen interest in natural philosophy, gave rise to a fertile ground for intellectual exchanges, which even today represent an important source of information about the process of rethinking natural philosophy, and indicate the subsequent renewal of the way of studying nature in the early modern era. Too often, however, the voices of the main protagonists in the Scientific Revolution, for example, the well-known Nicolaus Copernicus, Galileo Galilei, and Johannes Kepler, have overshadowed the role played by those other learned men, Tassoni included, who despite being considered 'outsiders', were nonetheless interested in the topics discussed and not only receptive to the novelties depicted, but also able to take part in the scientific debates and contribute to enriching the cultural landscape of sixteenth-century Italy.

In this sense, the reconstruction of Tassoni's scientific profile has been chosen as a focal point for understanding the intriguing early modern interplay between classical scholarship and the portrayal of astronomical novelties. We can certainly conclude from the analysis of Tassoni's scientific thinking that he was more than a mere passive reporter of the latest scientific discoveries or, conversely, a staunch defender of the traditional culture of his time. On the contrary, he himself looked for and employed such discoveries to comment critically on the traditional knowledge conveyed by adherents of Aristotle's teaching. Tassoni's work clearly attests to his intellectual curiosity, nourished throughout his life by the reading of different texts and authors from various backgrounds, fields of study, and time periods. There is also no doubt that the *Pensieri* is a product of early modern learned culture that was grounded in, but also expanded upon, Scholastic philosophical methods. Consequently, and particularly because of Tassoni's encyclopedic scope and variety of material, it is useful to compare him to other polymaths of Renaissance Italy. While many of these polymaths used unspecified sources or translated ancient texts literally,[1] Tassoni sought a synthesis of previous texts to represent his own thought and so is most similar to Alessandro Piccolomini. This synthesis is most evident in Tassoni's attitude towards Aristotle and especially reveals how Tassoni treads the fine line between innovation and conservatism as well as reflects contemporaneous intellectual trends. Thus, Tassoni's work suggests more broadly how the subdivision of knowledge into disciplinary sectors can be artificial and unproductive when studying early modern scientific culture.

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[1] Cf. Paolo Cherchi, *Polimatia di riuso. Mezzo secolo di plagio. (1539-1589)* (Rome: Bulzoni, 1998), p. 16.

Chapter 1 has emphasised how Tassoni's travels around different Italian academies and universities were conducive to the development of his scientific interests and the shaping of his critical acumen. Tassoni had a vast network of contacts, including in particular illustrious professors in the most lively cultural centres of Italy, namely, Pisa, Bologna, Ferrara, and Rome, where he studied and worked, and where, most importantly, he witnessed personally the birth of the debates, doctrines, and works that later historiography indicated as particularly significant. The influence of scientific ideas, including their rejection, that Tassoni experienced, is reflected in many of his scientific *quesiti*, and it would not be possible to build a picture of his understanding and position in relation to scientific debates without analysing, wherever possible, his connections with academies and universities. Tassoni's many and varied cultural experiences in different contexts fostered the sets of principles that underlay his scientific thinking. However, they also complicated the way he engaged with topics and, more specifically, contributed to the erratic way in which he introduced scientific topics into his *Pensieri diversi*. The original opinion of this work was that it was nothing more than a somewhat bizarre volume. On the contrary, as has been argued in Chapter 2, it is a valuable instrument that can be utilised to examine various questions with regard to the scientific culture of the time and their relationship with learned culture. As such, the work also helps to understand how other apparently 'minor figures' perceived and elaborated old and new ideas at the dawn of the Scientific Revolution. Such ideas not only affected the 'scientific community',[2] but also caught the attention of intellectuals, artisans, and technicians and, thus, circulated broadly in both lay and clerical environments. Academies, household libraries, and

[2] An exemplary work about the way in which the astronomical scholarly community shared information is Adam Mosley, *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge University Press, 2007). See also Robert S. Westman, 'The Astronomer's Role in the Sixteenth Century: A Preliminary Study', *History of Science*, 18 (1980), pp. 105–47.

courts became ideal places for cultural debates,[3] and Tassoni was a frequent visitor in such places, as we have seen.

By examining some of the physical–cosmological issues addressed by Tassoni, it has been possible to challenge the way in which he has been traditionally represented by historiography, which has paid scant attention to his scientific thinking. In fact, in this thesis, the selection, organisation, and analysis of Tassoni's *quesiti* (Chapters 3, 4, and 5) have confirmed his wide erudition and his ability to compare and evaluate different strands of knowledge to find his own way of explaining natural phenomena. The case studies on motion and on the cosmos reveal the influence of anti-Aristotelian naturalism on Tassoni's natural philosophy, and also reveal shades of Democritean and Lucretian cosmology. Tassoni's speculation is focused on the intrinsic features of bodies, which determine their motion and how they change, as well as on their place in the overall assessment of the cosmos, regardless of their final purpose (*telos*). Therefore, his conception of the universe is based on a discourse about the characteristics of bodies, and the difference between the celestial and terrestrial realms, which is due to heat or cold, respectively. The heavens are intrinsically hot, are devoid of hard spheres, and the celestial matter is an air-like substance that is still considered incorruptible; however, as a result of the new astronomical findings, it is deemed to be penetrable. It should be said that Tassoni's acceptance of some of the innovative proposals of his time did not mean he opposed Aristotle without question. His conception of the Earth as a cold place is the basis of his most conservative view of the cosmos: the acceptance of a geocentric system in which the Earth is considered to be immovable. As seen in the case study about the immobility of the Earth, in the late sixteenth and early seventeenth centuries, heliocentrism had its defenders, but at the same time the intervention of theologians in the cosmological field became more intense,

[3] See B. T. Moran, *Patronage and Institutions: Science, Technology and Medicine at the European Court: 1500−1750* (Rochester: The Boydell Press, 1991).

leading to the decree of the Congregation of the Index (forbidden books) on March 5 1616, which declared false and contrary to the Scriptures the thesis according to which the Earth moves and the Sun is immobile. Tassoni, a man of vast experience of Rome, was fully aware of the hostility faced by Galileo and Copernicanism during those years. By rejecting the theories of both the Aristotelians and the Copernicans, Tassoni made his own position clear in a way that allowed him to avoid any danger of falling foul of the political and religious authorities. In this sense, the scant attention paid by Tassoni to topics which were at the boundary of the scientific and religious discourse of the time, for example, the infinity and eternity of the world, is now fully understandable.

If in a distant past, in which interpretative keys such as ‘precursor/traditionalism’, ‘thesis recognised as scientifically correct/thesis recognised as scientifically incorrect’ were in force, Tassoni’s scientific thinking did not find a place, today, the history of philosophy and the history of science have developed in new directions. Now, crossing antiquated boundaries, these disciplines aim at a more accurate analysis and understanding of authors’ thinking and of the historical significance of their oeuvres. Thus, the time is ripe to study Tassoni as an intellectual with a wide-ranging knowledge of different disciplines and to pay attention to him as a ‘natural philosopher’. This is still an unexplored area of research; however, this work, although just an initial foray into the field, has had the ambition to show that such an investigation deserved to be conducted.

Contrary to what current historiography has often stated, I do not think that Tassoni was an ‘eccentric’ thinker moved principally by the desire to appear original at all costs. Rather, this work has demonstrated that he was seriously committed to analysing scientific topics and not fully persuaded by the physical doctrines circulating at the time. This is perfectly comprehensible. Tassoni’s lifetime coincided with a historical period during which the clash between tradition and novelty was felt particularly strongly and the sense of crisis was widespread; the old knowledge became more of a conceptual reference source, whereas new suggestions lacked the solid foundations on which to build a new spectrum of knowledge that would later be dominated by the partnership between physics and mathematics. Certainly, Tassoni looked for a personal synthesis of the different doctrines he took into account, conceptualising his own cosmological system made up of heterogeneous elements, which, however, still relies on the Aristotelian dynamics of bodies. More precisely, Tassoni's theories seem to be the expression of the attitude of a whole world of non-specialist scholars in the field of mathematics towards the nascent 'new science', which only found its place after a complex process of change wrought by the mathematisation of physics and the mathematised interpretation of experiments. It is worth remembering that Tassoni was writing at a time when not even Galileo had taken a step further in this direction. The work in which Galileo laid the foundations for modern mechanics and kinematics, his *Discorsi e dimostrazioni matematiche intorno a due nuove scienze attinenti alla mecanica e ai moti locali* (Discourses and Mathematical Demonstrations Relating to Two New Sciences), was published only in 1638. Consequently, Tassoni's work cannot be evaluated according to the characteristics representative of the epistemological breakthrough that is recognised nowadays as the Scientific Revolution.[4] The period during which Tassoni was taking part in the cosmological debates of his time was only the early years of the so-called Scientific Revolution. Therefore, the historical relevance of Tassoni's natural philosophy must emerge against the background of the context in which he expressed his ideas. Tassoni fits inside a triangle whose vertices are represented by Aristotelian physics, Italian naturalism, and the dawn of mathematised physics, and his natural philosophy does not coincide with any of these. Rather, he tried to make the three interact, creating a new zone within which fresh scientific knowledge was produced, the

[4] For insights into the evolution of scientific thinking and the methodological advancement of modern science, see Jutta Schickore, *About Method: Experimenters, Snake Venom and the History of Writing Scientifically* (Chicago: University of Chicago Press, 2017); Renn Jürgen, *The Evolution of Knowledge: Rethinking Science for the Anthropocene* (Princeton: Princeton University Press, 2020).

exploration of which contributes to our understanding of the evolution of scientific debates from the end of the Renaissance to the beginning of the modern age.

To conclude, early modern Europe, as has been demonstrated by Paolo Rossi and Eugenio Garin, is a privileged laboratory in which to observe intersections between the so-called Scientific Revolution and its cultural climate. More precisely, Rossi and Garin have shown that a scientific revolution cannot occur without a particular cultural *humus* and vice versa. Therefore, a scientific tradition cannot be considered independently of the culture in which it appears, and, as I have tried to show, Tassoni is an author who particularly embodies this intersection between the history of science and cultural history.

BIBLIOGRAPHY

Primary sources

Alessandro Tassoni's works

Tassoni, Alessandro. *La secchia rapita e scritti poetici*. Edited by Pietro Puliatti. Modena: Panini, 1989.

Tassoni, Alessandro. *La tenda rossa. Risposta di Girolamo Nomisenti a i Dialoghi di Falcidio Melampodio*. Frankfurt: n.p., 1613.

Tassoni, Alessandro. *Annali e scritti storici e politici*. Edited by P. Puliatti, 2 vols. Modena: Panini 1990–93.

Tassoni, Alessandro. *Avvertimenti di Crescenzio Pepe da Susa al sig. Giosefo de gli Aromatari*. Modena: Presso Giulian Cassiani, 1611.

Tassoni, Alessandro. *La secchia rapita*. 2 vols. Edited by Ottavio Besomi. Padua: Antenore, 1987–90.

Tassoni, Alessandro. *Lettere*. 2 vols. Edited by Pietro Puliatti. Bari: Laterza, 1978.

Tassoni, Alessandro. *Opere*. Edited by Luigi Fassò. Milan: Rizzoli and C. Editori, 1942.

Tassoni, Alessandro. *Pensieri e scritti preparatori*. Edited by Pietro Puliatti. Modena: Panini, 1986.

Tassoni, Alessandro. *Scritti inediti. Enrico, Discorso in biasimo delle lettere, Pro episcopis Venetis apologia, Annotazioni al vocabolario della crusca, Genealogia, Guerra di Valtellina, Testamento*. Edited by Pietro Puliatti. Modena: Aedes Muratoriana, 1975.

Other sources

Aristotle. *Aristotelis omnia quae extant opera*. 11 vols. Venice: Iuntas, 1573–76.

Aristotle. *Problemata*. Vol. 7 of 12 vols. Edited by E. S. Forster. In *The Works of Aristotle*. Edited by W. D. Ross. Oxford: Clarendon Press, 1927.

Aristotle. *Metaphysics, Vol. I: Books 1-9.* Translated by Hugh Tredennick. Loeb Classical Library 271. Cambridge, MA: Harvard University Press, 1933.

Aristotle. *Metaphysics*. In Aristotle, *Metaphysics, Vol. 2: Books 10-14, Oeconomica, Magna Moralia*. Translated by Hugh Tredennick, G. Cyril Armstrong. Loeb Classical Library 287. Cambridge, MA: Harvard University Press, 1935.

Aristotle. *On the Heavens*. Translated by W. K. C. Guthrie, LCL 338. Cambridge, MA: Harvard University Press, 1939.

Aristotle. *Generation of Animals*. Translated by A. L. Peck, LCL 366. Cambridge, MA: Harvard University Press, 1942.

Aristotle. *Meteorologica*. Translated by H. D. P. Lee, LCL 397. Cambridge, MA: Harvard University Press, 1952.

Aristotle. *On Coming-To-Be and Passing Away*. In Aristotle, *On Sophistical Refutations*, *On Coming-To-Be and Passing Away*, *On the Cosmos*. Translated by E. S. Forster and D. J. Furley, LCL 400. Cambridge, MA: Harvard University Press, 1955.

Aristotle. *On the Soul, Parva Naturalia, On Breath*. Translated by W. S. Hett, LCL 288. Cambridge, MA: Harvard University Press, 1957.

Aristotle. *Physics*. 2 vols. Translated by P. H. Wicksteed and F. M. Cornford, LCL 228 and LCL 255. Cambridge, MA: Harvard University Press, 1934, 1957.

Bernardi, Antonio. *Disputationes. In quibus primum ex professo monomachia quam singulare certamen Latini, recentiores duellum vocant philosophicis rationibus astruitur [...] accessit locuples rerum & verborum toto opere memorabilium, index*. Basel: Henricus Petrus and Nicolaus Bryling, 1562.

Biancani, Giuseppe. *Sphaera mundi, seu Cosmographia demonstrativa ac facili methodo tradita: in qua totius mundi fabrica, una cum novis, Tychonis, Kepleri, Galilaei aliorumque astronomorum adinventis continetur: accessere I. Brevis introductio ad geographiam, II. Apparatus ad mathematicarum studium, III. Echometria, id est geometrica traditio de echo*. Bologna: Sebastianus Bonomius and Hieronymus Tamburinus, 1620.

Borro, Girolamo. *De motu gravium et levium*. Florence: Officina Georgii Marescotti, 1576.

Brahe, Tycho. *Opera omnia*. 15 vols. Edited by John Louis Emil Dreyer. Copenhagen: Libraria Gyldendaliana, 1913–29.

Brahe, Tycho. *Tychonis Brahe, Dani de nova et nullius aevi memoria prius visa stella, iam pridem Anno à nato Christo 1572, mense Novembrj primùm conspecta, contemplatio mathematica*. Copenhagen: Laurentius Benedictj, 1573.

Buonamici, Francesco. *De motu libri X*. Florence: Bartholomaeus Sermartellius, 1591.

Campanella, Tommaso. *Philosophia sensibus demonstrata in octo disputationes distincta*. Naples: Horatius Salvianus, 1591.

Cardano, Girolamo. *De rerum varietate libri XVII. Adiectus est capitum, rerum et sententiarum notatu dignissimarum index*. Basel: Henricus Petrus, 1557.

Cardano, Girolamo. *De subtilitate, libri XXI*. Nuremberg: Johannes Petreius, 1550.

Cardano, Girolamo. *The 'De Subtilitate' of Girolamo Cardano*. 2 vols. Edited by John M. Forrester. Tempe: Arizona Center for Medieval and Renaissance Studies, 2013.

Caro, Annibale. *Apologia de gli Academici di Banchi di Roma, contra m. Lodovico Castelvetro da Modena*. Parma: Seth Viotto, 1558.

Clavius, Christoforo. *In sphaeram Ioannis de Sacro Bosco commentarius*. *Nunc tertio ab ipso auctore recognitus, et plerisque in locis locupletatus*. Rome: Domenico Basa, 1585.

Clavius, Christoforo. *In sphaeram Ioannis de Sacro Bosco commentarius. Nunc quartò ab ipso auctore recognitus et plerísque in locis locupletatus*. Lyon: Fratrum de Gabiano, 1593.

Clavius, Christoforo. *In Sphaeram Ioannis de Sacro Bosco Commentaries*. Edited by Eberhard Knobloch. Reprint of the 1611 edition. Hildesheim: Olms-Weidmann, 1999.

Copernicus, Nicholas. *Complete Works*. 2 vols. Baltimore: The Johns Hopkins University Press, 1992.

Copernicus Nicolaus. *De revolutionibus orbium celestium*. *La costituzione generale dell'universo*. Edited by Alexandre Koyré and translated by Corrado Vivanti. Turin: Einaudi, 1975.

Coronelli, Vincenzo. *Biblioteca universale sacro-profana, antico-moderna, in cui si spiega con ordine alfabetico ogni voce, anco straniera, che può avere significato nel nostro idioma italiano, appartenente a' qualunque materia*. Vol 6 of 7 vols. Venice: Antonio Tivani, 1701-1706. 436−42.

De Sacrobosco, Johannes. 'The Sphere of Sacrobosco'. In *The Sphere of Sacrobosco and Its Commentators*. Translated by Lynn Thorndike. Chicago: University of Chicago Press, 1949.

Delle Colombe, Ludovico. *Contro il moto della Terra*, *con* Postille *di Galileo*. Vol. 3 of 20 vols. In *Le opere di Galileo Galilei*. Edited by Antonio Favaro. Florence: G. Barbèra, 1929-39. 251–90.

Euclid. *Euclidis optica & catoptrica nunquam antehac Graece aedita eadem Latine reddita per Ioannem Penam [...]; his praeposita est eiusdem Ioannis Penae de vsu optices praefatio*. Paris: Andreas Wechelus, 1557.

Foscarini, Paolo Antonio. *Foscarini e la sua lettera sulla mobilità della terra. Scienza e fede nell'opera del carmelitano montaltese. Testo integrale della Lettera sopra l'opinione de'Pittagorici e del Copernico, della mobilità della Terra e stabilità del Sole e del nuovo pittagorico sistema del mondo* [1615]. Edited by Romeo Luciano. Cosenza: Editoriale progetto, 2000, 2018.

Frangipane, Cornelio C. *Discorso del s. Cl. Cornelio Frangipani sopra la stella, che è apparsa nell'anno 1572 in Tramontana, dove discorrendosi di che ella sia composta, si dicchiara grandissimi effetti, che deve apportare*. Venice: Domenico and Giovanni Battista Guerra, 1573.

Galilei, Galileo. *Iuvenilia*. 20 vols. Edited by Antonio Favaro. Florence: Barbera, 1890–1909.

Galilei, Galileo. *Opere di Galileo Galilei*. Edizione Nazionale. Edited by Favaro Antonio. Florence: Giunti Barbera, 1890–1909.

Galilei, Galileo. *Le opere di Galileo Galilei*. Florence: Barbera Editore, 1935.

Galilei, Galileo. *Dialogue Concerning the Two Chief World Systems, Ptolemaic and Copernican*. Translated by Drake Stillman. Berkeley: University of California Press, 1967.

Galilei, Galileo. *Dialogo sopra i due massimi sistemi del mondo tolemaico e copernicano*. Edited by Ottavio Besomi and Mario Helbing. Padua: Antenore, 1998.

Galilei, Galileo and Mario Guiducci. *Discorso delle comete*. Edited by Ottavio Besomi and Mario Helbing. Rome: Editrice Antenore, 2002.

Galilei, Galileo. *Scienza e religione. Scritti copernicani*. Edited by Massimo Bucciantini and Michele Camerota. Rome: Donzelli, 2009.

Galileo, Galilei. *Collected Works of Galileo Galilei*. Hastings: Delphi Classics, 2017.

Garimberti, Girolamo. *Problemi naturali, e morali di Hieronimo Garimberto* Venice: Bottega d'Erasmo di Vincenzo Valgrisi, 1549.

Giacchini, Leonardo. *De acutorum morborum curatione disputatio. Eiusdem, quæstionum naturalium, libellus*. Lyon: Seb. Gryphius, 1540.

Giuntini, Francesco. *Discorso sopra la cometa apparsa nel mese di nouembre 1572* Venice: Domenico Farri, 1573.

Kepler, Johannes. *Ad Vitellionem paralipomena, quibus astronomiae pars optica traditur; potissimùm de artificiosa obseruatione et aestimatione diametrorum deliquiorumque solis et lunae. Cum exemplis insignium eclipsium. Habes hoc libro, lector, inter alia multa noua, tractatum luculentum de modo visionis et humorum oculi vsu, contra opticos et anatomicos, authore Ioanne Keplero [...]*. Frankfurt: Claudius Marnius et haeredes Ioannis Aubrii, 1604.

Kepler, Johannes. *Joannis Kepleri astronomi opera omnia*. 9 vols. Edited by Christian Frisch. Frankfurt and Erlangen: Heyder and Zimmer, 1858–1871.

Lando, Ortensio. *Quattro libri de dubbi con le solutioni a ciascun dubbio accommodate. La materia del primo è naturale, del secondo è mista benche per lo piu sia morale del terzo è amorosa, & del quarto è religiosa*. Venice: Gabriel Giolito de Ferrari, et fratelli, 1552.

Manfredi, Girolamo. *Liber de homine. Il perché*. Anna Laura Trombetti Budriesi and Fabio Foresti (eds.). Bologna: Edizioni Luigi Parma, 1988.

Marta, Giacomo Antonio. *Pugnaculum Aristotelis, adversus principia Bernardini.* Rome: Bartholomaeus Bonfandinus, 1587.

Patrizi, Francesco. *Discussionum Peripateticarum tomi 4* Basle: ad Perneam Lecythum, 1581.

Patrizi, Francesco. *Nova de universis philosophia: in qua Aristotelica methodo non per motum sed per lucem & lumina ad primam causam ascenditur* Ferrara: apud Benedictum Mammarellum, 1591.

Pico della Mirandola, Giovanni Francesco. *Examen vanitatis doctrinae gentium, et veritatis Christianae disciplinae, distinctum in libros sex, quorum tres omnem philosophorum sectam vniuersim, reliqui Aristoteleam et Aristoteleis armis particulatim impugnant, vbicunque autem Christiana et asseritur et celebratur disciplina*. Mirandola: Ioannes Maciochius Bundenius, 1520.

Plato. *Timaeus, Critias, Cleitophon, Menexenus, Epistles*. Translated by R. G. Bury Cambridge, MA: Harvard University Press, 1999.

Plutarch. *Plutarchi Cheronei de placitis philosophorum naturalibus libri quinq per magistrum*. Rome: Iacobus Mazochius, 1510.

Plutarch. *De primo frigido*. In Plutarch, *Plutarchi Chaeronensis moralia*. Basel: Thomas Guarinus, 1570.

Ptolemy. *Opera quae exstant omnia*. Edited by Emilie A. Boer. Leipzig: Teubner, 1898–1952.

Raimondo, Annibale. *Dichiarationi [...] contra quelli che hanno scritto che la stella delle maraviglie 1572 [...] fusse cometa, e non stella fissa*. N.p., 1573.

Raimondo, Annibale. *Discorso sopra la stella che il Novembre et Decembre 1572 ha reso tanta marauiglia a infiniti di diuerse nationi, e a gran parte d'essi fatto parlare tanto diversamente. Al sereniss. Principe et all'ill.mo et eccell.mo Maggior Conseglio di Venetia* and *Dichiarationi [...] contra quelli che hanno scritto che la stella delle maraviglie 1572 [...] fusse cometa, e non stella fissa*. N.p., 1573.

Riccioli, Giovanni Battista. *Almagestum novum astronomiam veterem novamque complectens. Observationibus aliorum, et propriis novisque theorematibus, problematibus, ac tabulis promotam. In tres tomos distributam quorum argumentum sequens pagina explicabit avctore Ioanne Baptista Ricciolo*. Bologna: Haeredis Victorij Benatij, 1651.

Rossi, Giovanni Vittorio. *Iani Nicii Erithraei Pinacotheca*. Cologne: Iodocus Kalcovius et socios, 1645.

Schoppe, Caspar. *Pascasii Grosippi. Paradoxa literaria in quibus multa de literis noue contra Ciceronis, Varronis, Quinctiliani, aliorumque literatorum hominum, tam veterum, quam recentiorum, sententiam disputantur. Ad Ferdinandum Henriquez a Riuera*. Milan: Io. Baptista Bidellius, 1628.

Seneca. *Natural Questions*. Translated by Harry M. Hine. Chicago: University of Chicago Press, 2010.

Telesio, Bernardino. *Varii de naturalibus rebus libelli ab Antonio Persio editi. Quorum alij nunquàm antea excusi, alij meliores facti prodeunt. Sunt autem hi De cometis, & lacteo circulo. De his, quæ in aere fiunt. De iride. De mari. Quod animal vniuersum. De usu respirationis. De coloribus. De saporibus. De somno. Unicuique libello appositus est capitum index*. Venice: Felice Valgrisius, 1590.

Telesio, Bernardino. *Varii de naturalibus rebus libelli.* Edited by L. De Franco Florence: La Nuova Italia, 1981.

Telesio, Bernardino. *De iis quae in aere fiunt et de terraemotibus*. *De mari*. Translated by Francesco Martelli and edited by Luigi De Franco. Cosenza: Editoriale Bios, 1990.

Telesio, Bernardino. *Sobre los cometas y la Via Lactea*. Translated by Miguel A. Granada. Madrid: Tecnos, 2012.

Telesio, Bernardino. *De rerum natura iuxta propria principia, libri IX* [1586]. Edited by Guido Giglioni. Rome: Carocci, 2013.

Telesio, Bernardino. *De rerum natura iuxta propria principia, liber primus, et secundus, denuo editi* [1570]*, Opuscola* [1570]. Edited by Roberto Bondì. Rome: Carocci, 2013.

Valdagno, Giuseppe. *Discorso intorno a la stella, che negl'ultimi mesi dell'anno 1572 è stata veduta con inusitato, et meraviglioso splendore*. Milan: Ambrosiana, ms. R 95 sup.

Virgil. *Aetna*. Edited by H. A. J. Munro. Cambridge: Deighton Bell, 1867.

Zeno, Apostolo. [Preface to], *Annotazioni sopra il Vocabolario degli Accademici della Crusca. Opera postuma di Alessandro Tassoni modonese, riscontrata con molti testi a penna. Aggiuntavi una lettera intorno a questa ed altre opere del Tassoni*. Venice: Marino Rossetti, 1689.

Secondary sources

Allegra, Antonio and Vinti, Carlo. *Federico Cesi e il suo tempo*. Assisi: Edizioni Porziuncola, 2005.

Ambrosi, Luigi. *Sopra i 'Pensieri diversi' di Alessandro Tassoni*. Rome: Loescher, 1896.

Aristotle. *La generazione e la corruzione*. Edited by M. Migliori and L. Palpacelli. Milan: Bompiani, 2013.

Baldini, Ugo. *Christoph Clavius e l'attività scientifica dei Gesuiti nell'età di Galileo*. *Atti del Convegno Internazionale. Chieti, 28–30 aprile 1993*. Rome: Bulzoni, 1995.

Arcudi, Bruno Anthony. *Alessandro Tassoni and his rôle in the intellectual life of the Seicento* (Ph.D. Yale University, 1955).

Baldi, Marialuisa and Canziano, Giulio (eds.). *Girolamo Cardano. Le Opere, le Fonti, la Vita*. Milan: Franco Angeli, 1999.

Baldini, Ugo. 'Bellarmino tra vecchia e nuova scienza. Epistemologia, cosmologia, fisica'. In *Roberto Bellarmino arcivescovo di Capua, teologo e pastore della Riforma Cattolica. Atti del convegno internazionale di studi, Capua 28 settembre–1 ottobre 1988*. 2 vols. Edited by Galeota Gustavo. Capua: Archidiocesi di Capua, 1990. 629–90.

Baldini, Ugo. 'La teoria astronomica in Italia durante gli anni della formazione di Galileo: 1560–1610'. In *Lezioni galileiane I. Alle origini della rivoluzione scientifica*. Edited by Casini Paolo. Rome: Istituto della Enciclopedia Italiana, 1991. 39–67.

Baldini, Ugo. *Legem impone subactis. Studi su filosofia e scienza dei Gesuiti in Italia, 1540–1632*. Rome: Bulzoni, 1992.

Baldini, Ugo. *Saggi sulla cultura della Compagnia di Gesù secoli XVI–XVIII*. Padua: CLEUP Editrice, 2000.

Bellini, Eraldo. *Stili di pensiero nel Seicento italiano. Galileo, i Lincei, i Barberini.* Pisa: ETS, 2009.

Bellini, Eraldo. *Umanisti e Lincei. Letteratura e Scienza a Roma nell'Età di Galileo*. Padua: Antenore, 1997.

Barker, Peter. 'The Optical Theory of Comets from Apian to Kepler'. *Physis* 30 (1993): 1–25.

Baroncini, Gabriele. 'L'insegnamento della filosofia naturale nei collegi italiani dei Gesuiti 1610–1670. Un esempio di un nuovo aristotelismo'. In *La ratio studiorum. Modelli culturali e pratiche educative dei Gesuiti in Italia tra Cinque e Seicento*. Edited by Gian Paolo Brizzi. Rome: Bulzoni, 1981. 163–215.

Barone, Francesco. 'La modernità di Niccolò Copernico'. In *Copernico e la questione copernicana in Italia dal XVI al XIX secolo*. Edited by Luigi Pepe. Florence: Olschki, 1996, 1–28.

Battistini, Andrea. 'Avvisaglie del moderno in Alessandro Tassoni'. In *Alessandro Tassoni. Poeta, erudito, diplomatico*. Edited by Cabani, Maria Cristina and Duccio Tongiorgi (Modena: Franco Cosimo Panini, 2017). 15–16.

Battistini, Andrea. *Galileo e i Gesuiti. Miti letterari e retorica della scienza*. Milan: Vita e pensiero, 2000.

Belloni, Antonio. Review of 'L. Ambrosi, Sopra i Pensieri diversi di Alessandro Tassoni'. *Giornale storico della letteratura italiana* 15 (1897): 483.

Berker, Peter. 'Copernicus and the Critics of Ptolemy'. *Journal for the History of Astronomy* 30 (1999): 343–58.

Berti, Enrico. 'Genesi e sviluppo della dottrina della potenza e dell'atto in Aristotele'. *Studia Patavina* 5 (1958): 477–505.

Berti, Enrico. *Dalla dialettica alla filosofia prima*. Padua: CEDAM, 1977.

Berti, Enrico. 'La generazione dell'uomo secondo Aristotele'. In *Nuovi studi aristotelici. Fisica, antropologia, metafisica*. Edited by Berti E. Vol. 2 of 5 vols. Brescia: Morcelliana, 2005. 150–57.

Berti, Enrico. 'Quando esiste l'uomo in potenza? La tesi di Aristotele'. In *Nuovi studi aristotelici*. *Fisica, antropologia, metafisica*. Edited by Berti E. Vol. 2 of 5 vols. Brescia: Morcelliana, 2005143–50.

Bianchi, Luca. ‘Uccelli d’oro e pesci di piombo. Galileo Galilei e la potentia Dei absoluta’. In *Sopra la volta del mondo. Onnipotenza e potenza assoluta di Dio tra medioevo e età moderna*. Edited by M. T. Fumagalli and Beonio Brocchieri. Bergamo: Lubrina, 1986. 139–46.

Bianchi, Luca. *Studi sull’aristotelismo rinascimentale*. Padua: Il Poligrafo, 2003.

Bianchi, Luca. ‘Hauendo lui publicato sette fogli di carta. Leandro Pizzoni e la reputazione scientifica di Galileo’. *Rivista di storia della filosofia* 71, no. 4 (2016): 16–44.

Bianchi, Luca. ‘Una caduta senza declino? Considerazioni sulla crisi dell'Aristotelismo fra Rinascimento ed età moderna’. In *Aristotelica et Lulliana. Magistro doctissimo Charles H. Lohr septuagesimum annum feliciter agenti dedicata*. Edited by Fernando Dominguez et al. Steenbrugis: Abbatia S. Petri, 1995.

Bianchi, Luca, Gilson, Simon, and Kraye, Jill. *Vernacular Aristotelianism in Italy from the Fourteenth to the Seventeenth Century*. London: Warburg Institute, 2016.

Bilancia, Elena and Reggiani, Samuele. ‘Polemica tra Annibale Caro e Ludovico Castelvetro’. *Polemiche Letterarie del Cinquecento*. Ururi: Al segno di Fileta, 2018.

Blackwell, J. Richard. *Galileo, Bellarmine and the Bible: Including a Translation of Foscarini’s Letter on the Motion of the Earth*. Notre Dame: University of Notre Dame Press, 1991.

Blair, M. Ann. ‘The “Problemata” as a Natural Philosophical Genre’. In *Natural Particulars: Nature and the Disciplines in Renaissance Europe*. Edited by Anthony Grafton and Nancy Siraisi. Cambridge, MA: MIT Press, 1999. 171–204.

Blum, R. Paul. *Studies on Early Modern Aristotelianism*. Leiden: Brill, 2012.

Boccolari, Giorgio. ‘Bibliografia Tassoniana’. *Atti e memorie della Deputazione di Storia Patria per le Antiche Provincie Modenesi* 8, no. 12 (1960).

Boccolari, Giorgio. ‘Il diploma di laurea di Alessandro Tassoni’. In *Studi tassoniani. Atti e memorie del convegno nazionale di studi per il IV centenario della nascita di Alessandro Tassoni. Modena 6-7 novembre 1965*. Edited by Deputazione di Storia Patria per le Antiche Province Modenesi. Modena: Aedes muratoriana, 1966. 93–101.

Bolzoni, Lina. ‘Il segretario neoplatonico. F. Patrizi, A. Querenghi, V. Gramigna: analisi della corte e delle diverse forme di produzione intellettuale e materiale ad essa collegata’. In *La corte e il cortegiano*. Edited by Adriano Prosperi. Vol. 2, *Un modello europeo*. Rome: Bulzoni, 1980. 133–69.

Bondì, Roberto. *Il primo dei moderni. Filosofia e scienza in Bernardino Telesio*. Rome: Edizioni di Storia e Letteratura, 2018.

Boner, Patrick J. *Change and Continuity in Early Modern Cosmology*. Dordrecht: Springer, 2011.

Bönker-Vallon, Angelika. 'L'unità del metodo e lo sviluppo di una nuova fisica. Considerazioni sul significato del De l'infinito, universo e mondi di Giordano Bruno per la scienza moderna'. *Bruniana e Campanelliana* 6, no. 1 (2000): 35–56.

Bonucci, Elisabetta, et al. *Galileo e l'universo dei suoi libri. Catalogo della mostra tenuta alla Biblioteca Nazionale di Firenze, 5 dicembre 2008–28 febbraio 2009*. Florence: Vallecchi, 2008.

Brunello, Bruno. 'Motivi filosofici nel pensiero di Alessandro Tassoni'. In *Studi tassoniani. Atti e memorie del Convegno nazionale di studi per il 4. centenario della nascita di Alessandro Tassoni: Modena, 6–7 novembre 1965*. Edited by Deputazione di Storia Patria per le Antiche Province Modenesi Modena: Aedes Muratoriana, 1966. 123–24.

Bucciantini, Massimo. *Galileo e Keplero. Filosofia, cosmologia e teologia nell'età della Controriforma*. Turin: G. Einaudi, 2003.

Bucciantini, Massimo, Camerota, Michele and Giudice, Franco. *Galileo's Telescope: A European Story*. Translated by Catherine Bolton. Cambridge, MA: Harvard University Press, 2015.

Bucciantini, Massimo, Camerota, Michele and Roux, Sophie. *Mechanics and Cosmology in the Medieval and Early Modern Period*. Florence: Olschki, 2007.

Bucciantini, Massimo, Camerota, Michele and Giudice, Franco. *Il caso Galileo, una rilettura storica, filosofica e teologica. Convegno internazionale di studi, Florence, 26–30 May 2009*. Florence: Olschki, 2011.

Butterfield, Herbert. *Le origini della scienza moderna*. Bologna: il Mulino, 1962.

Cabani, Maria Cristina and Tongiorgi, Duccio. *Alessandro Tassoni. Poeta, erudito, diplomatico nell'Europa dell'età moderna*. Modena: Franco Cosimo Panini, 2017.

Calisi, Daniele. *Luce ed ombra nella rappresentazione. Rilettura storica e sperimentazioni idiomatiche*. Ariccia: Aracne, 2015.

Camerota, Michele and O. Helbing, Mario. 'Galileo and Pisan Aristotelianism: Galileo's De Motu Antiquiora and the Quaestiones De Motu Elementorum of the Pisan Professors'. *Early Science and Medicine* 5, no. 4 (2000): 319–65.

Camerota, Michele. 'I De motu antiquiora di Galileo e il Discorso idrostatico del 1612. Affinità e differenze'. *Annali della Facoltà di scienze della formazione dell'Università di Cagliari*, 23 (2000): 75–98.

Camerota, Michele. *Galileo Galilei e la cultura scientifica nell'età della Controriforma*. Rome: Salerno, 2004.

Camerota, Michele. 'La biblioteca di Galileo. Alcune integrazioni e aggiunte desunte dal carteggio'. In *Biblioteche filosofiche e private in età moderna e contemporanea*. Edited by Francesca Maria Crasta. Florence: Le lettere, 2010, 81–95.

Camerota, Michele, Giudice, Franco and Ricciardo, Salvatore. *Galileo ritrovato. La lettera a Castelli del 21 dicembre 1613*. Brescia: Morcelliana, 2019.

Campanelli, Maurizio. *Le Accademie a Roma nel Seicento*. Roma: Edizioni di Storia e Letteratura, 2020.

Campori, Giuseppe. 'Appunti intorno ad Alessandro Tassoni'. *L'indicatore modenese* 2 (1852): 3–42.

Caputo, Vincenzo. *Profili letterari*. Pisa: Giardini, 1963.

Carducci, Giosuè. *La secchia rapita e l'Oceano di Alessandro Tassoni*. Florence: Barbèra, 1858.

Caroti, Stefano. 'Un sostenitore napoletano della mobilità della terra. Il padre Paolo Antonio Foscarini'. In *Galileo e Napoli*. Edited by Lomonaco Fabrizio and Torrini Maurizio. Naples: Guida, 1987. 81–121.

Carugo, Adriano and Crombie, Alistair C. 'The Jesuits' and Galileo's Ideas of Science and Nature'. *Annali dell'Istituto e Museo di Storia della Scienza di Firenze* 8 (1983): 3–67.

Carugo, Adriano, 'Les jésuite et la philosophie naturelle de Galilée. Benedictus Pererius et le "De motu gravium" de Galilée'. *History and Technology* 4 (1987): 321–33.

Casalini, Cristiano. *Jesuit Philosophy on the Eve of Modernity*. Leiden: Brill, 2019.

Casini, Tommaso and Santi, Venceslao. *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta, 28 giugno 1908*. Bologna and Modena: A. F. Formiggini, 1908.

Cassiani, Giuliano. 'Elogio di Alessandro Tassoni'. *Raccolta di elogi e orazioni di genere dimostrativo composte dai professori dell'Università di Modena I*. Modena: Società Tipografica, 1820. 30–67.

Caverni, Raffaello. *Storia del metodo sperimentale in Italia*. 6 vols. Florence: Stab. G. Civelli, 1891–1900.

Cereseto, Giovanni Battista. *Della epopea in Italia considerata in relazione colla storia della civiltà*. Turin: Pomba, 1853.

Cherchi, Paolo. 'Il quotidiano, i "Problemata" e la meraviglia. Ministoria di un microgenere'. *Intersezioni* 21, no. 2 (2001): 243–76.

Cherchi, Paolo. *Polimatia di riuso. Mezzo secolo di plagio. (1539-1589)*. Rome: Bulzoni, 1998.

Cherniss, Harold F. *Aristotle's Criticism of Plato and the Academy*. Baltimore: Johns Hopkins University Press, 1944.

Christianson, J. R. 'Tycho Brahe's German Treatise on the Comet of 1577: A Study in Science and Politics'. *Isis* 70 (1979): 110–40.

Christianson, John R., et al. *Tycho Brahe and Prague: Crossroads of European Science. Proceedings of the International Symposium on the History of Science in the Rudolphine Period*, *Prague, 22–25 October 2001*. Frankfurt: Deutsch, 2002.

Cifoletti, Giovanna. ‘La nuova edizione di Apologia pro Tychone contra Ursum di Keplero. Teoria e storia delle ipotesi astronomiche’. *Rivista di storia della filosofia* 42, no. 3 (1987): 465–80.

Cifres, Alejandro. *L’inquisizione romana e i suoi archivi. A vent’anni dall’apertura dell’ACDF. Atti del Convegno, Roma, 15–17 maggio 2018. Memoria fidei*. Rome: Gangemi, 2019.

Coradeschi, Gabriele. ‘Contro Aristotele e gli aristotelici. Tycho Brahe e la nova del 1572 in Italia’. *Galilæana: Journal of Galilean Studies* 6 (2009) 89–122.

Cosci, Matteo. ‘Astronomia pavana nel Dialogo de Cecco di Ronchitti da Bruzen in perpuosito de la stella nuova tra commedia, satira, disputatio accademica e poesia’. In *Generi dell’aristotelismo volgare nel Rinascimento*, Edited by Marco Sgarbi Padua: CLEUP, 2018, 125–87.

Cosci, Matteo. ‘Le fonti di Galileo Galilei per le Lezioni e studi sulla stella nuova del 1604’. *Archives internationales d’histoire des sciences* 68, nos. 180–181 (2018): 6–70.

Coyne, George V. ‘The Jesuits and Galileo: Fidelity to Tradition and the Adventure of Discovery’. *Forum Italicum* 49 (2015): 154–65.

Craig, Martin. *Subverting Aristotle: Religion, History, and Philosophy in Early Modern Science*. Baltimore: Johns Hopkins University Press, 2014.

Cunningam, Andrew. ‘The Identity of Natural Philosophy: A Response to Edward Grant’. *Early Modern Science and Medicine* 5, no. 3 (2000): 259−78.

D’Agostino, Renata. ‘Due note Tassoniane’. *Filologia e critica* 4, nos. 2–3 (1979): 416–33.

D’Ancona, Alessandro and Bacci, Orazio. *Manuale della letteratura italiana*. Vol. 3 of 6 vols. Florence: Barbera, 1904.

De Angelis, Simone. ‘Pendasio, Federico’. In *Encyclopedia of Renaissance Philosophy*. Cham: Springer, 2015.

De Pace, Anna. *Niccolò Copernico e la fondazione del cosmo eliocentrico. Con testo, traduzione e commentario del Libro I de Le rivoluzioni celesti*. Milan: B. Mondadori, 2009.

De Risi, Vincenzo. ‘Francesco Patrizi e la nuova geometria dello spazio’. In *Locus-spatium. XIV Colloquio internazionale, Rome, 3–5 January 2013*. Edited by Giovannozzi Delfina and Veneziani Marco. Florence: Olschki, 2014. 269–327.

Debenedetti, Santorre. *Gli studi provenzali in Italia nel Cinquecento e tre secoli di studi provenzali*. Edited by Segre Cesare. Padua: Antenore, 1995.

De Ceglia, Francesco P. *De natantibus. Una disputa ai confini tra filosofia e matematica nella Toscana medicea, 1611-1615*. Bari: G. Laterza, 1999.

De Pace, Anna. *Niccolò Copernico e la fondazione del cosmo eliocentrico*. Milan: Bruno Mondadori, 2009.

De Pace, Anna. *Galileo lettore di Copernico*. Firenze: Olschki, 2020.

De Salvo, Assunta. *Un paradosso di Galileo. Una chiave di lettura della disputa idrostatica*. Pisa: ETS, 2010.

Del Prete, Antonella. *Universo infinito e pluralità dei mondi. Teorie cosmologiche in età moderna*. Naples: La Città del Sole, 1998.

Del Soldato, Eva. *Early Modern Aristotle: On the Making and Unmaking of Authority*. Philadelphia: University of Pennsylvania Press, 2020.

Diels, Hermann and Kranz, Walther. *I presocratici. Testo greco a fronte*. Edited by Reale Giovanni. Milan: Bompiani, 2006.

Donahue, William H. *The Dissolution of the Celestial Spheres 1595–1650*. New York: Arno Press, 1981.

Drake, Stillman. 'Galileo Gleanings, VIII: The Origin of Galileo's Book on Floating Bodies and the Question of the Unknown Academician'. *Isis* 51 (1960): 56–63.

Drake, Stillman. *Galileo Studies: Personality, Tradition and Revolution*. Ann Arbor: University of Michigan Press, 1970.

Drake, Stillman. *Galileo at Work: His Scientific Biography*. Chicago: University of Chicago Press, 1978.

Drake, Stillman. 'Galileo's Steps to Full Copernicanism and Back'. *Studies in History and Philosophy of Science* 18 (1987): 93–105.

Duhem, Pierre. *Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*. 10 vols. Paris: Hermann, 1913–59.

Umberto, Eco. *L'isola del giorno prima.* Milan: Bompiani, 2003.

Eastwood, Bruce S. *The Revival of Planetary Astronomy in Carolingian and Post-Carolingian Europe*. Aldershot: Ashgate, 2002.

Emiliani-Giudici, Paolo. *Storia delle belle lettere in Italia*. Florence: Società Editrice Fiorentina, 1844.

Fabbri, Natacha and Favino, Federica. *Copernicus Banned: The Entangled Matter of the Anti-Copernican Decree of 1616*. Firenze: L.S. Olschki, 2018.

Falcon, Andrea. *Aristotle and The Science of Nature: Unity Without Uniformity*. Cambridge: Cambridge University Press, 2008.

Falcon, Andrea. 'A Late Ancient Discussion of Celestial Motion: PSI XIV 1400', *Papiri filosofici* 4 (2003): 129−41.

Falcon, Andrea. *Corpi e movimenti. Il De caelo di Aristotele e la sua fortuna nel mondo antico*. Naples: Bibliopolis, 2001.

Fassò, Luigi. 'Tassoni Alessandro'. In *Enciclopedia italiana*. Rome: Treccani, 1937.

Favaro, Antonio. 'Le aggiunte autografe di Galileo al Dialogo sopra i due massimi sistemi nell'esemplare posseduto dalla Biblioteca del Seminario di Padova'. *Memorie della R. Accademia di scienze, lettere ed arti di Modena* 19 (1880): 245–75.

Favaro, Antonio. 'Galileo Galilei, Benedetto Castelli e la scoperta delle fasi di Venere'. *Archivio di storia della scienza*. Vol. 1 of 8 vols. (1919-1920): 283−96.

Favaro, Antonio. 'La libreria di Galileo Galilei, descritta ed illustrata'. *Bullettino di bibliografia e storia delle scienze matematiche e fisiche* 19 (1886): 219–93.

Favaro, Antonio. 'Appendice prima alla libreria di Galileo Galilei'. *Bullettino di bibliografia e storia delle scienze matematiche e fisiche* 20 (1887): 372–76.

Favaro, Antonio. *La libreria di Galileo Galilei*, *estratto dal Bullettino di bibliografia e di storia delle scienze matematiche e fisiche, tomo 19, maggio-giugno 1886/descritta ed illustrata da Antonio Favaro*. Rome: Tipografia delle Scienze matematiche e fisiche, 1887.

Favaro, Antonio. 'Serie undecima di scampoli galileiani. LXXIX, Appendice seconda alla Libreria di Galileo'. *Atti e memorie della R. Accademia di scienze, lettere ed arti in Padova* 12 (1896): 44–50.

Favino, Federica. 'Clavio, il cosmo, il tempo'. In *Magistri astronomiae dal XVI al XIX secolo. Catalogo della mostra, Roma nov. 2014–feb. 2015*. Edited by Valentina Nicolucci. Rome: De Luca Editori, 2014. 31–45.

Feldhay, Rivka. *Galileo and the Church: Political Inquisition or Critical Dialogue?* Cambridge: Cambridge University Press, 1995.

Ferrari, Giuseppe. *Corso sugli scrittori politici italiani*. Milan: Manini, 1862.

Ferraro, Luca. *Nel laboratorio di Alessandro Tassoni: lo studio del "Furioso" e la pratica della postilla*. Florence: Franco Cesati Editore, 2018.

Ferroni, Giulio. *Storia della letteratura italiana. Dal Cinquecento al Settecento*. Milan: Mondolibri, 2000.

Finocchiaro, Maurice. *Defending Copernicus and Galileo: Critical Reasoning in the Two Affairs*. New York: Springer, 2010.

Finocchiaro, Maurice. *On Trial for Reason: Science, Religion and Culture in the Galileo Affair*. Oxford: Oxford University Press, 2019.

Finocchiaro, Maurice. *The Galileo Affair: A Documentary History*. New York: The Notable Trials Library, 1991.

Finocchiaro, Maurice. *Retrying Galileo, 1633–1992*. Berkeley: University of California Press, 2005.

Fiorentino, Francesco. *Bernardino Telesio ossia studi storici su l'idea della natura nel Risogimento italiano*. Vol 2 of 2 vols. Florence: Le Monnier, 1872-1874.

Firpo, Luigi. 'Filosofia italiana e controriforma, IV: La proibizione di Telesio'. *Rivista di filosofia* 42, no. 1 (1951): 30–47.

Firpo, Massimo and Ferroni, Vincenzo. 'Galileo tra inquisitori e microstorici'. *Rivista storica italiana* 97, no. 1 (1985): 177–238.

Flora, Francesco. *Storia della letteratura italiana*. Vol. 2 of 5 vols. *Il Seicento, il Settecento*. Verona: Mondadori, 1953.

Forlivesi, Marco. 'Politica e scienza tra XVI e XVII secolo. Gli esempi di Cesare Cremonini e Galileo Galilei'. *Atti e memorie dell'Accademia Galileiana di scienze lettere ed arti in Padova, già dei Ricovrati e Patavina. Pt. 3*, *Memorie della Classe di scienze morali lettere ed arti*. 125 (2012–13): 3–34.

Freedberg, David. *The Eye of the Lynx: Galileo, His Friends and the Beginnings of Modern Natural History*. Chicago: The University of Chicago Press, 2002.

Fusco, Enrico M. *Scrittori e idee. Dizionario critico della letteratura italiana*. Turin: Società editrice internazionale, 1956.

Gabrieli, Giuseppe. *La prima biblioteca Lincea o libreria di Federico Cesi*. Rome: G. Bardi, 1939.

Gabrieli, Giuseppe. Contributi alla storia della Accademia dei Lincei. 2 Vols. Rome: Accademia Nazionale dei Lincei, 1989.

Gaddi, Paolo. *Nella solenne inaugurazione del monumento ad Alessandro Tassoni, prose e versi, 26 novembre 1860*. Modena: Vincenzi, 1860.

Galluzzi, Paolo. *Momento. Studi galileiani*. Rome: Edizioni dell'Ateneo e Bizzarri, 1979.

Galluzzi, Paolo (ed.). *Novità celesti e crisi del sapere. Atti del convegno internazionale di studi galileani, Pisa-Venezia-Padova-Firenze, 18-26 marzo 1983*, Firenze: Giunti-Barbera, 1984.

Gannagé, Emma. 'Alexandre d'Aphrodise In de generatione et corruptione apud Gabir b. Hayyan K. al Tasrif'. *Documenti e studi sulla tradizione filosofica medievale*, 9 (1998): 35–86.

Gannagé, Emma. 'Matière et élements dans le commentaire d'Alexandre d'Aphrodisie In De generatione et corruptione'. In *Aristotele e Alessandro di Afrodisia nella tradizione araba. Atti del colloquio La ricezione araba ed ebraica della filosofia e della scienza greche. Padova, 14–15 maggio 1999*. Edited by Cristina D'Ancona and Giuseppe Serra. Padua: Il poligrafo, 2002. 133–49.

Garin, Eugenio. *Rinascite e rivoluzioni. Movimenti culturali dal XIV al XVIII secolo*. Roma: Laterza, 2007.

Gatti, Hilary. *Giordano Bruno and Renaissance Science*. Ithaca, NY: Cornell University Press, 1999.

Geymonat, Ludovico. *Galileo Galilei: A biography and Inquiry into His Philosophy of Science*. Translated by Stillman Drake. New York: McGraw Hill, 1965.

Gerini, Emanuele. *Memorie storiche d'illustri scrittori e di uomini insigni dell'antica e moderna Lunigiana*. Vol. 2 of 2 vols. Sala Bolognese: Arnaldo Forni, 1986, pp. 144−46.

Ghisalberti, Alessandro. *Giovanni Buridano dalla metafisica alla fisica*. Milan: Vita e pensiero, 1992.

Gimma, Giacinto. *Idea della storia dell'Italia letterata*. Naples: Felice Mosca, 1723.

Gingerich, Owen. *The Great Copernicus Chase and Other Adventures in Astronomical History*. Cambridge: Sky Publishing Corporation and Cambridge University Press, 1992.

Gingerich, Owen. 'The Galileo Affair', *Scientific American* 247, no. 2 (1982), 132−43.

Gironi, Robustiano. 'Vita di Alessandro Tassoni'. In *Vita e ritratti di illustri italiani*. Bologna: Tipografia governativa, 1844. 288–96.

Goddu, André. *Copernicus and the Aristotelian Tradition: Education, Reading and Philosophy in Copernicus's Path to Heliocentrism*. Leiden: Brill, 2010.

Granada, M. Ángel. *El debate cosmológico en 1588. Bruno, Brahe, Rothmann, Ursus, Röslin*. Naples: Bibliopolis, 1996.

Granada, M. Ángel. *Palingenio, Patrizi, Bruno, Mersenne. El enfrentamiento entre el principio de plenitud y la distinción potentia absoluta/ordinata Dei a propósito de la necesidad e infinitud del universo*. Milan: Angeli, 2000.

Granada, M. Ángel. *Giordano Bruno. Universo infinito, unión con Dios, perfección del hombre*. Barcelona: Herder, 2002.

Granada, M. Ángel. 'Giordano Bruno y el final de la cosmología aristotelica'. In *Galileo y la gestación de la ciencia moderna*. Canarias: Consejería de Educacíon, Cultura y Deportes del Gobierno de Canarias, , 2001, pp. 97−118.

Granada, M. Ángel. *Sfere solide e cielo fluido. Momenti del dibattito cosmologico nella seconda metà del Cinquecento*. Milan: Guerini e associati, 2002.

Granada, M. Ángel. 'Telesio y las novedades celestes. La teoría telesiana de los cometas'. *Ingenium. Revista electrónica de pensiamento moderno y metodología en historia de la ideas* 3 (2010): 22–47.

Granada, M. Ángel. *Novas y cometas entre 1572 y 1618. Revolución cosmológica y renovación política y religiosa*. Barcelona: Universitat de Barcelona, 2012.

Grant, Edward. 'Aristotelianism and the longevity of the medieval world view'. *History of science* 16 (1978): 93−106.

Grant, Edward. ‘Celestial Matter: A Medieval and Galilean Cosmological Problem’. *Journal of Medieval and Renaissance Studies* 13 (1983): 157−86.

Grant, Edward. *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution*. Cambridge: Cambridge University Press, 1981.

Grant, Edward. *In Defense of the Earth’s Centrality and Immobility: Scholastic Reaction to Copernicanism in the Seventeenth Century*. Philadelphia: American Philosophical Society, 1984.

Grant, Edward. *Planets, Stars, and Orbs: The Medieval Cosmos 1200–1687*. Bloomington: Cambridge University Press, 1994.

Grant, Edward. *A History of Natural Philosophy: From the Ancient World to the Nineteenth Century*. Bloomington: Cambridge University Press, 2007.

Grant, Edward. ‘Ways to interpret the terms 'Aristotelian' and 'Aristotelianism' in Medieval and Renaissance Physics’, *History of science*, 25 (1987): 336−358.

Grant, Edward. *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts* (Cambridge: Cambridge University Press, 1996.)

Guerrini, Olindo. ‘Alessandro Tassoni 1565–1635’. In *La vita italiana nel Seicento. Conferenze tenute a Firenze nel 1894*. Edited by G. Falorsi et al. Milan: Treves, 1897. 225–46.

Guerrini, Luigi. *Cosmologie in lotta: le origini del processo di Galileo*. Firenze: Edizioni Polistampa, 2010.

Guerzoni, Erminia. *Alessandro Tassoni. Studio biografico-critico*. Palermo: Tip. Fratelli Vena, 1911.

Guglielminetti, Marziano. ‘Tassoni e Marino’. In *Studi tassoniani. Atti e memorie del Convegno nazionale di studi per il 4. centenario della nascita di Alessandro Tassoni: Modena, 6–7 novembre 1965*. Edited by Deputazione di Storia Patria per le Antiche Province Modenesi Modena: Aedes Muratoriana, 1966. 147–76.

Hall, Crystal. *Galileo’s Reading*. Cambridge: Cambridge University Press, 2013.

Hall, Crystal. ‘Galileo’s Library Reconsidered’. *Galilæana: Journal of Galilean Studies* 12 (2015): 29–82.

Helbing, Mario O. *La filosofia di Francesco Buonamici professore di Galileo a Pisa*. Pisa: Nistri-Lischi, 1989.

Hellman, C. Doris. ‘The New Star of 1572: Its Place in the History of Astronomy’. In *Actes du IXe Congrés International d’Histoire des Sciences*. Barcelona: Universidad de Barcelona-Hermann, 1959. 482–87.

Hellman, C. Doris. ‘Maurolico’s Lost Essay on the New Star of 1572’. *Isis* 51 (1960): 322–36.

Hellman, C. Doris. ‘Was Tycho Brahe as Influential as He Thought?’, *British Journal for the History of Science*, 1 (1963): 290–300.

Hellman, C. Doris. *The Comet of 1577: Its Place in the History of Astronomy.* New York: AMS Press, 1971.

Ingaliso, Luigi. *Filosofia e cosmologia in Christoph Scheiner*. Soveria Mannelli: Rubbettino, 2005.

Ingegno, Alfonso. *Cosmologia e filosofia nel pensiero di Giordano Bruno*. Florence: La nuova Italia, 1978.

Ingegno, Alfonso. *Saggio sulla filosofia di Cardano*. Florence: La nuova Italia, 1980.

Isoldi Jacobelli, Angelamaria. *Tommaso Campanella. Il diverso filosofar mio* (Rome: Laterza, 1995).

Jardine, Nicholas. *The Birth of History and Philosophy of Science: Kepler's ‘A Defence of Tycho against Ursus’: With Essays on Its Provenance and Significance*. Cambridge: Cambridge University Press, 1984.

Koyré, Alexandre. *Études galiléennes*. Paris: Hermann, 1966.

Koyré, Alexandre. *From the Closed World to the Infinite Universe*. Baltimore: Johns Hopkins University Press, 1957.

Kraye, Jill. ‘The Philosophy of the Italian Renaissance’. In *The Renaissance and 17th century Rationalism*. Edited by G. H. R. Parkinson. London: Routledge, 2003: 15−64.

Kuhn, Thomas S. *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* Cambridge, MA: Harvard University Press, 1957.

Lawn, Brian. *The rise and decline of the scholastic Quaestio disputata. With special emphasis on its use in the teaching of medicine and science*, Leiden: E.J. Brill, 1993.

Lazzarini, Andrea. ‘Tassoni Alessandro’. In *Dizionario biografico degli italiani*. Rome: Istituto della Enciclopedia italiana, 2019.

Lerner, Michel-Pierre. ‘La science galiléenne selon Tommaso Campanella’ *Bruniana and Campanelliana*, 1 (1995): 122−56.

Lerner, Michel-Pierre. ‘Sicut nodus in tabula. De la rotation propre du soleil au seizième siècle’. *Journal for the History of Astronomy* 11 (1980): 114–29.

Lerner, Michel-Pierre. *Tre saggi sulla cosmologia alla fine del Cinquecento*. Naples: Bibliopolis, 1992.

Lerner, Michel-Pierre. *Il mondo delle sfere. Genesi e trionfo di una rappresentazione del cosmo*. Translated by Antonella Del Prete. Milan: La Nuova Italia, 2000.

Lerner, Michel-Pierre. *Le monde des sphères*. 2 vols. Paris: Les belles lettres, 2008.

Lerner, Michel-Pierre. 'Le problème de la matière céleste après 1550'. *Revue d'histoire des sciences* 42 (1989): 255−280.

Lines, David. 'Natural Philosophy in Renaissance Italy'. *Early Science and Medicine*, 6, 4 (2001): 267−320.

Lines, David and Refini, Eugenio (eds.), *Aristotele fatto volgare: tradizione aristotelica e cultura volgare nel Rinascimento* (Pisa: ETS, 2014)

Lohr, Charles H. 'The sixteenth-century transformation of the aristotelian natural philosophy'. *Aristotelismus und Renaissance. In memoriam Charles B. Schmitt*. Edited by von Eckhard Kessler, Charles H. Lohr and Walter Sparn. Wiesbaden: Harrassowitz, 1988, pp. 89−99.

Lohr, Charles H. 'Renaissance Authors'. In *Latin Aristotle's Commentaries.* Vol. 2 of 3 vols. (Florence, L.S. Olschki, 1988−2010).

Malara, Ivan Giuseppe. *Galileo Galilei e il tema cosmogonico della creazione del mondo*: *Tesi di laurea*. Università degli studi di Milano, Facoltà di studi umanistici, Corso di laurea magistrale in Scienze filosofiche, 2015–16. 49–59.

Malara, Ivan Giuseppe. 'Galileo and His Sources? A Different Methodological Approach to Galileo's "Juvenilia"', *Galilaeana: Journal of Galilean Studies* 16 (2019): 1–40.

Mammola, Simone. *Il problema della grandezza della terra e dell'acqua negli scritti di Alessandro Piccolomini, Antonio Berga e G. B. Benedetti e la progressiva dissoluzione della cosmologia delle sfere elementari nel secondo '500*. Berlin: Max Planck Institut für Wissenschaftsgeschichte, 2014.

Maylender, Michele. *Storia delle Accademie d'Italia*. 5 vols. Bologna: Cappelli, 1926–30.

Meli, D. Bertoli. *Thinking with Objects: The Transformation of Mechanics in the Seventeeth Century*. Baltimore: Johns Hopkins University Press, 2006.

Merlin, Pierpaolo and Ieva, Frédéric. *Monferrato 1613. La vigilia di una crisi europea*. Rome: Viella, 2016.

Mestica, Giovanni. *Gli svolgimenti del pensiero italiano nel Seicento*. Palermo: Tipografia Lo Statuto, 1893.

Michel, Paul-Henri. *The Cosmology of Giordano Bruno*. Translated by R.E.W. Maddison. London: Methuen, 1973.

Moran, Bruce. T. 'Christoph Rothmann, the Copernican Theory, and Institutional and Technical Influences on the Criticism of Aristotelian Cosmology'. *Sixteenth Century Journal* 13 (1982): 85–108.

Moraux, Paul. *L'aristotelismo presso i Greci*, 3 Vols. (Milan: Vita e Pensiero, 2000).

Mordechai, Feingold. *The New Science and Jesuit Science: Seventeenth-Century Perspectives*. Dordrecht: Kluwer, 2003.

Morhof, Daniel Georg. *Polyhistor literarius philosophicus et practicus*. Lübeck: Peter Bockmann, 1714.

Motta, Franco. 'I criptocopernicani. Una lettura del rapporto fra censura e coscienza intellettuale nell'Italia della Controriforma'. In *Largo campo di filosofare. Eurosymposium Galileo 2001*. Edited by Montesinos José and La Orotava Carlos Solís. La Orotava: Fundación Canaria Orotava de Historia de la Ciencia, 2001. 693–718.

Motta, Franco. *Bellarmino. Una teologia politica della Controriforma*. Brescia: Morcelliana, 2005.

Motta, Franco. *Roberto Bellarmino. Teologia e potere nella Controriforma*. Edited by Catto Michela. Milan: Il sole 24 ore, 2014.

Motta, Uberto. 'Querenghi e Galileo: l'ipotesi copernicana nelle immagini di un umanista'. *Aevum* 67, no. 3 (1993): 595–616.

Motta, Uberto. *Antonio Querenghi 1546–1633. Un letterato padovano nella Roma del tardo Rinascimento*. Milan: Vita e pensiero, 1997.

Muccillo, Maria. *Platonismo, ermetismo e prisca theologia. Ricerche di storiografia filosofica rinascimentale*. Florence: Olschki, 1996.

Muratori, Lodovico Antonio. *Vita di Alessandro Tassoni*. Modena: Bartolomeo Soliani, 1739.

Muratori, Lodovico Antonio. *Raccolta delle opere minori di Ludovico Antonio Muratori*. Napoli: Alfano, 1762.

Mussini, Cesare. *Scrittori Italiani con notizie storiche e letterarie*. Turin: Paravia, 1940.

Nascimbeni, Giovanni. *La filosofia naturale di Alessandro Tassoni*. Jesi: Tipografia cooperativa editrice, 1905.

Nascimbeni, Giovanni. 'Che cosa c'è al centro della terra secondo Plutarco, Dante e Alessandro Tassoni'. In *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta*. Edited by Tommaso Casini and Venceslao Santi. Modena: A. F. Formiggini, 1908. 249–65.

Neaf, Heinrich. *Due contributi alla storia dei Pensieri di Alessandro Tassoni*. Trieste: Herrmanstorfer, 1911.

Neu, Stephanie. *Alessandro Tassoni (1565–1635). Metamorphosen des Epos*. Frankfurt: Peter Lang, 2012.

Nunziante, Ferdinando. *Il conte Alessandro Tassoni ed il Seicento*. Milan: Emilio Quadri editore, 1885.

Olschki, Leonardo. *Geschichte der neusprachlichen wissenschaftlichen Literatur*. Vol. 2, *Bildung und Wissenschaft in Zeitalter der Renaissance in Italien*. Leipzig: Olschki, 1922.

Omodeo, Pietro Daniel. *Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation*. 2 vols. Berlin: Max Planck Institut für Wissenschaftsgeschichte, 2012.

Osborne, Toby. *Dynasty and Diplomacy in the Court of Savoy: Political Culture and the Thirty Years' War*. Cambridge: Cambridge University Press, 2002.

Paolino, Laura. 'Giovanni Talentoni da Fivizzano e l'incipit del Canzoniere di Petrarca'. *Italian Studies* 75, no. 1 (2020). 41–54.

Papagni, Erika. *L'antipetrarchismo nell'opera di Alessandro Tassoni*. Toronto: University of Toronto Press, 2014.

Parini, Giuseppe. 'De' principi particolari delle Belle Lettere'. In *Opere di Giuseppe Parini*. Vol. 1 of 6 vols. Edited by Francesco Reina. Milan: Stamp. e Fond. del Genio Tipografico, 1804. 135–251.

Park, Katharine and Daston, Lorraine. *The Cambridge History of Science*. Vol. 3, *Early Modern Science*. Cambridge: Cambridge University Press, 2008.

Patrizi, Francesco. *Nova de universis philosophia. Materiali per un'edizione emendata*. Edited by Puliafito Bleuel, Anna Laura. Florence: L.S. Olschki, 1993.

Peruzzi, Enrico. 'Critica e rielaborazione del sistema copernicano in Giovanni Antonio Magini'. In *La diffusione del copernicanesimo in Italia: 1543–1610*. Edited by Massimo Bucciantini and Maurizio Torrini. Florence: Olschki, 1997. 83–98.

Pieri, Mario. [Review of] 'Studi tassoniani'. *Convivium* 37, no. 3 (1969): 324–45.

Pitoni, Francesco. *Sopra i 'Pensieri diversi' di Alessandro Tassoni*. Livorno: G. Meucci, 1882.

Pizzamiglio, Pier Luigi. 'Le biblioteche di Copernico e Galileo e il ruolo della stampa nella nascita della scienza moderna'. In *Galileo e Copernico. Alle origini del pensiero scientifico moderno*. Edited by Carlo Vinti. Perugia: Porziuncola, 1992. 115–40.

Pompeati, Arturo. *Storia della letteratura italiana*. Vol. 3 of 4 vols. Turin: Utet, 1948.

Ponzio, Paolo. *Tommaso Campanella. Filosofia della natura e teoria della scienza*. Bari: Levante, 2001.

Ratti, Vincenzo. *Alessandro Tassoni. Discorso letto per la distribuzione dei premi agli alunni delle scuole d'Asti addi 18 aprile 1884 da Vincenzo Ratti*. Asti: Scuola Tip. Michelerio, 1884.

Ray, Meredith K. *Margherita Sarrocchi's Letters to Galileo: Astronomy, Astrology and Poetics in Seventeenth-Century Italy*. New York: Palgrave Macmillan, 2016.

Redondi, Pietro. *Galileo eretico*. Rome: Laterza, 2009.

Renzetti, Roberto. *Dal mondo di Aristotele all'opera di Giordano Bruno e Galileo Galilei attraverso scienza, filosofia e teologia*. Rome: Tempesta, 2016.

Ricci, Saverio. ‘I Lincei. L’invenzione della mediazione accademica. Nuova scienza, religione, vita civile’. In *Sciences et religions, de Copernic à Galilèe 1540–1610. Actes du colloque international organize par l’Ècole française de Rome, en collaboration avec l’Ècole nationale des chartes et l’Istituto italiano per gli studi filosofici, avec la participation de l’Università di Napoli ‘Federico II’, Rome 12–14 décembre 1996*. Rome: Ècole française de Rome, 1999. 205–34.

Rigault, Hippolyte. *Histoire de la querelle des anciens e des modernes*. Paris: Librairie Hachette, 1856.

Riondato, Ezio and Poppi, Antonino. *Cesare Cremonini. Aspetti del Pensiero e Scritti. Atti del Convegno di studio, Padova, 26-27 febbraio 1999*. 2 Vols. Padua: Accademia Galileiana di Scienze, Lettere ed Arti, 2000.

Rosen, Edward. *Copernicus and the Scientific Revolution*. Malabar: Krieger, 1984.

Rosen, Edward. ‘Francesco Patrizi and the Celestial Spheres’. *Physis* 26 (1984): 305–24.

Rossi, Giorgio. *Saggio di una bibliografia ragionata delle opere di Alessandro Tassoni con un discorso su gli scritti editi e inediti di lui*. Bologna: Zanichelli, 1908.

Rossi, Paolo. *Il tempo dei maghi. Rinascimento e modernità*. Milan: R. Cortina, 2006.

Rossi, Paolo. *La nascita della scienza moderna in Europa*. Rome: Laterza, 2011.

Rossi, Pietro and Viano, C. Augusto. *Storia della filosofia*, 6 vols. Rome: Laterza, 1993–99.

Rotondò, Antonio. ‘La censura ecclesiastica e la cultura’. *Storia d’Italia* 5 (1973): 1399–1492.

Russo, Emilio. ‘Castelvetro nel primo Seicento Tassoni, Marino, Stigliani’. *Atti e memorie dell’Arcadia* 2 (2013): 121−38.

Russo, Lucio and Santoni, Emanuela. *Ingegni minuti. Una storia della scienza in Italia.* Milan: Feltrinelli, 2010.

Sacchiero Parri, Fiorella. *Lettere e minute inedite di Alessandro Tassoni 1600-1604*. Lugano: Tipografia ETF, 1997.

Salvia, Stefano. ‘From Archimedean Hydrostatics to Post-Aristotelian Mechanics: Galileo’s Early Manuscripts De Motu Antiquiora ca. 1590’. *Physics in Perspective* 19 (2017): 105–50.

Santella, Stefania. ‘L'Aetna, App. Verg. Scienza ed etica’. In *Scienza antica in età moderna. Teoria e immagini*. Edited by Maraglino Vanna. Bari: Cacucci, 2012. 376−87.

Santi, Venceslao. ‘Alessandro Tassoni e il cardinal Ascanio Colonna’. *Atti e Memorie della R. Deputazione di Storia Patria per le Antiche Provincie Modenesi* 2, no. 5 (1903): 197–210.

Santi, Venceslao. *Il fedelissimo amico di Alessandro Tassoni*. Modena: Società tipografica, 1926.

Schmitt, Charles B., Skinner, Quentin and Kessler, Eckhard with Kraye, Jill. *The Cambridge History of Renaissance Philosophy*. Cambridge: Cambridge University Press, 1988.

Schmitt, Charles B. *Problemi dell'aristotelismo rinascimentale*. Translated by Antonio Gargano. Naples: Bibliopolis, 1985.

Sciaccaluga, Nicoletta. 'Movimento e materia in Bacone. Uno sviluppo telesiano'. *Annali Della Scuola Normale Superiore Di Pisa. Classe Di Lettere e Filosofia* 2, no. 1 (1997): 329–55.

Settembrini, Luigi. *Lezioni di letteratura italiana*. Vol. 2 of 3 vols. Naples: Stabilimento Tipografico Ghio, 1868.

Setti, Giovanni. 'Tassoni e Montaigne'. In *Miscellanea tassoniana di studi storici e letterari. Pubblicata nella festa della Fossalta, 28 giugno 1908*. Edited by Tommaso Casini and Venceslao Santi. Bologna and Modena: A. F. Formiggini, 1908. 227–41.

Sgarbi, Marco. 'Aristotle and the People: Vernacular Philosophy in Renaissance Italy'. *Renaissance and Reformation* 39 (2017): 59–109.

Shea, William R. *Discorso intorno alle cose che stanno in su l'acqua o che in quella si muovono*. Florence: G. Barbèra, 1967.

Shea, William R. *Galileo's Intellectual Revolution*. London: MacMillan, 1972.

Shea, William R. 'Galileo's discourse on floating bodies: Archimedean and Aristotelian elements', *International congress of the history of science*, 12 (1968): 149−53.

Sirri, Raffaele and Torrini, Maurizio. *Bernardino Telesio e la cultura napoletana*. Naples: Guida, 1992.

Spruit, Leen. 'Elementi aristotelici e polemica anti-peripatetica nella dottrina dell'anima divina di Telesio'. *Verifiche* 21, no. 4 (1992): 351–70.

Tabarroni, Giorgio. 'L'inserimento dei Gesuiti nell'astronomia moderna'. In *Christoph Clavius e l'attività scientifica dei Gesuiti nell'età di Galileo. Atti del Convegno Internazionale. Chieti, 28–30 aprile 1993*. Edited by Baldini Ugo. Rome: Bulzoni, 1995. 159–67.

Tessicini, Dario. 'Il dibattito italiano sulla nuova stella del 1572 con il testo del "Discorso intorno a la stella" di Giuseppe Valdagno, ms Ambrosiana R 95 sup.'. In *Novas y cometas entre 1572 y 1618. Revolución cosmológica y renovación política y religiosa*. Edited by Miguel Ángel Granada. Barcelona: Universitat de Barcelona, 2012. 43–94.

Tessicini, Dario. *I dintorni dell'infinito. Giordano Bruno e l'astronomia del Cinquecento.* Pisa: F. Serra, 2007.

Thoren, Victor E. 'The Comet of 1577 and Tycho Brahe's System of the World'. *Archives internationales d'histoire des sciences* 29 (1979): 53–67.

Thorndike, Lynn. *A History of Magic and Experimental Science*. New York: Macmillan, 1941.

Tiraboschi, Girolamo. *Biblioteca modenese o notizie della vita e delle opere degli scrittori natii degli stati del serenissimo signor duca di Modena*. Vol. 5 of 6 vols. Modena: Presso la Società Tipografica, 1784.

Toffanin, Giuseppe. *Machiavelli e il 'Tacitismo'. La 'politica storica' al tempo della controriforma*. Padua: Angelo Draghi, 1921.

Torrini, Maurizio. 'La biblioteca di Galileo e dei galileiani'. *Intersezioni* 21 (2001): 545–58.

Turri, Vittorio and Renda, Umberto. *Dizionario storico critico della letteratura italiana*. Turin: Paravia, 1944.

Shapin, Steven. 'The Man of Science'. In *The Cambridge History of Science*. Edited by by K. Park and L. Daston. Vol. 3, pp. 179−92.

Vasoli, Cesare. *L'enciclopedismo del Seicento*. Naples: Bibliopolis, 1978.

Vasoli, Cesare. 'Su alcune obiezioni di Francesco Patrizi al Telesio'. In *Atti del Convegno internazionale di studi su Bernardino Telesio*. Edited by Accademia Cosentina. Cosenza: Tipolitografia Di Giuseppe, 1990. 193–205.

Vasoli, Cesare. 'Francesco Patrizi sull'infinità dell'universo'. In *Filosofia e cultura. Per Eugenio Garin*. Vol. 1 of 2 vols. Edited by Michele Ciliberto and Cesare Vasoli. Rome: Editori Riuniti, 1991. 276–308.

Vasoli, Cesare. 'Francesco Patrizi da Cherso e la critica del concetto aristotelico dell'eternità del mondo, del tempo e del moto'. In '*Sapientiam amemus*'. *Humanismus und Aristotelismus in der Renaissance*, *Festschrift für Eckhard Kessler zum 60 Geburtstag*. Edited by P. R. Blum, C. Blackwell, and C. Lohr. Munich: Fink, 1999. 141–79.

Vasoli, Cesare. *Le filosofie del Rinascimento*. Milan: Mondadori, 2002.

Vasoli, Cesare. 'La critica di Francesco Patrizi alla dottrina aristotelica degli elementi. Il fuoco, l'aria e l'acqua'. *Rinascimento* 5, no. 47 (2007): 93–106.

Vasoli, Cesare. 'Sophismata putida. La critica alla dottrina peripatetica dell'eternità e immutabilità del cielo'. In *Francesco Patrizi. Filosofo platonico nel crepuscolo del Rinascimento*. Edited by Patrizia Castelli. Florence: Olschki, 2002. 167–80.

Ventura, Iolanda. 'Aristoteles Fuit Causa Efficiens Huius Libri: on the Reception of Pseud-Aristotle's Problemata in Late Medieval Encyclopaedic Culture'. In *Aristotle's Problemata in Different Times and Tongues*. Edited by Pieter De Leemans and Michèle Goyens. Leuven: Leuven University Press, 2006. 113–44.

Ventura, Iolanda. 'Per Modum Quaestionis Compilatum...: The Collections of Natural Questions and Their Development from the Thirteenth to the Sixteenth Century'. In *All You Need to Know: Encyclopaedias and the Idea of General Knowledge*, *Conference Proceedings, Prangins, Switzerland, 18–20 Sept. 2003*. Edited by P. Michel. Aachen: Shaker Verlag, 2007. 275–318.

Ventura, Iolanda. 'Les recueils de questions-réponses à l'Époque Moderne. Une forme de transmission du savoir scientifique?'. In *SHS Web of Conferences*, *vol. 22 2015. Les* *séries de problèmes, un genre au carrefour des cultures. LabEx HASTEC, Paris, 2011–2014*. Edited by Alain Bernard. Les Ulis: EDP Sciences, 2015.

Ventura, Iolanda. 'Quaestiones and Encyclopedias: Some Aspects of the Late Medieval Reception of Pseudo-Aristotelian Problemata in Encyclopaedic and Scientific Culture'. In *Schooling and Society: The Ordering and Reordering of Knowledge in the Western Middle Ages*. Edited by A. A. MacDonald and M. W. Twomey. Leuven: Peeters, 2004, pp. 23–42.

Védrine, Hélène. *La conception de la nature chez Giordano Bruno*. Paris: Librairie philosophique J. Vrin, 1999.

Vesel, Matjaž. 'Francesco Patrizi, a Renaissance Philosopher and the Science of Astronomy'. In *Francesco Patrizi: Philosopher of the Renaissance. Proceedings from The Centre for Renaissance Texts Conference 24–26 April 2014*. Edited by Tomáš Nejeschleba and Paul R. Blum. Olomouc: Univerzita Palackého v Olomouci. 314–42.

Viesseux, G. Pietro. *Archivio storico italiano ossia raccolta di opere e documenti finora inedita o divenuti rarissimi risguardanti la storia d'Italia.* Vol. 7, *Appendice*. Florence: Deputazione Toscana di Storia Patria, 1849.

Walker, Joseph Cooper. *Memoirs of Alessandro Tassoni, Author of La Secchia Rapita; or, the Rape of the Bucket; Interspersed with Occasional Notices of His Literary Contemporaries, and a General Outline of His Various Works*. Edited by Samuel Walker. London: Longman, Hurst, Rees, Orme, and Brown, 1815.

Wallace, William A. *Galileo's Early Notebooks: The Physical Questions. A Translation from the Latin with Historical and Paleographical Commentary.* Notre Dame: University of Notre Dame Press, 1977.

Weijers, Olga. *In search of the truth. A history of disputation techniques from antiquity to early modern times*, Turnhout: Brepols, p. 38.

Weijers, Olga. "Les genres littéraires à la faculté des arts", *Revue des sciences philosophiques et théologiques*, vol. 82, 4 (1998), pp. 631–41.

Westman, Robert S. *The Copernican Question: Prognostication, Skepticism and Celestial Order*. Berkeley: University of California Press, 2011.

Zambrini, Francesco. *Cenni biografici intorno ai letterati illustri italiani, o, brevi memorie di quelli che co' loro scritti illustrarono l'italico idioma. Si parla pure della maggior parte de'novellieri, e de' più grandi scientifici anche scrittori di non troppo buona lingua: de' più valenti istorici della letteratura italiana, e de' principali corruttori del buon gusto*. Faenza: presso Montanari e Marabini, 1837.

Zandomeneghi, Elena. 'L'Oceano di Alessandro Tassoni, Master's thesis. Università Ca'Foscari di Venezia, 2016.

Zirardini, Giuseppe. *L'Italia letteraria ed artistica. Galleria di cento ritratti de' poeti, prosatori, scultori, architetti e musici più illustri con cenni storici*. Paris: Baudry, 1850.