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SCIENCE IN THE MARGINS. READING PURPOSES OF GALILEO'S 17th-CENTURY SCHOLARS

Renée Raphael, *Reading Galileo. Scribal Technologies and the "Two New Sciences"*, Baltimore, Johns Hopkins University Press, 2017.

Is the conceptual categorization of Galileo's readers between "supporters", "opponents" or somewhere in between, as historiography has done until recent times, still valid? Is using the image of immeasurably conflicting paradigms as the engine of scientific evolution – following the model of Thomas Kuhn – an approach capable of doing justice to the eclectic forms of thought developed in periods of great change and, ultimately, will it allow an exhaustive reading of the work of figures considered to be secondary? (see pp. 192-194)

Renée Raphael's book attempts to answer these and other questions pertinent to crucial moments in the history of science in the early modern period through an innovative and extremely rigorous methodological approach. She has studied copies of the last work published by Galileo Galilei which are of great interest to historians because they originally belonged to scholars from different countries and backgrounds and contain their handwritten annotations. The aim of her research was to clarify the reception of the *Two New Sciences* in Europe in order to understand how a text presented as a harbinger of new scientific truths was accepted and used, but from a broader perspective than its immediate contribution to the science of mechanics in the 17th century. The first four chapters are devoted to the study of the approach and techniques adopted by scholars to annotate, correct or implement the ideas contained in the *Two New Sciences*, while the last two are dedicated to the reception of Galileo's hypotheses in the academic world, using as examples the University of Pisa and the colleges of the Jesuit order.

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In her book Raphael presents an important body of largely unpublished material, and the research methodology adopted – focusing on the phenomenology of the reading and study of the Galilean text – had yielded enlightening information and exposes some interesting new links. However, the conclusions drawn are somewhat obscured by the author's conceptualization of the phenomenon. She writes:

> Existing studies largely explore how readers evaluated the *Two New Sciences*, emphasizing when readers agreed or disagreed with Galileo and the methods – experimentation, mathematical calculation, or philosophical reasoning – they used to arrive at their determinations. The new readers I identified, in contrast, seemed to care little about such issues (p. 4).

This assertion is repeated several times, but the author's analysis ends up supporting both the thesis and its antithesis for a simple and logical reason; even if the work was not being read with the conscious intention of rejecting or accepting Galileo's hypotheses, the fact remains that where further research ideas – whether theoretical or experimental – were inspired by the *Two New Sciences*, this implied a confirmation or refutation of the assertions, but absolutely no one – unless motivated by the desire to manipulate the work for his own ends – would have studied Galileo with the overt intent of proving the falsity or truthfulness of certain of his hypotheses. In the pursuit of scientific knowledge, choosing to underline or pass over the merits or demerits of the colleague who, for example, first hypothesized the explanation of a phenomenon, is a dynamic that may change. Depending on the cultural context and intellectual environment of the period, there may be a greater or lesser motivation among different schools of thought to engage in a confrontation as a collateral feature of scientific research. The examination of some of the chapters of *Reading Galileo* will show that just such an interpretation could be made of the reception of Galileo's last work.

In her first chapter Raphael analyses the annotations to a copy of the *Two New Sciences* that plausibly belonged to the physicist, mathematician, and friend and correspondent of Galileo, Giovanni Battista Baliani (1582-1666), referred to by her with cautious prudence as Pseudo-Baliani.[1] In the annotations we detect a certain perplexity regarding Galileo's axiomatic construction of a science of motion. Pseudo-Baliani objected that the nature of accelerated motion could be demonstrated either by a proof based on experimental evidence or by demonstrative

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[1] Biblioteca Nazionale Centrale di Firenze (hereafter BNCF), MS *Gal.*, 80.

reasoning, rather than on a probabilistic argumentation. In this regard, the extensor of the notes, whether he was Baliani or some other scholar, shows himself in all his modernity, where he underlines how the definition of accelerated motion presented in accordance with the concept of natural motion remains, in the *Two New Sciences*, a substantially undemonstrated argument.

Thus, Raphael correctly observes that Pseudo-Baliani could be defined as a modern reader, for his approach to Galileo's work was not based on the humanist and Aristotelian tradition, where knowledge was primarily accumulated to serve as a weapon for rhetorical and dialectical purposes. He was instead oriented toward the search for the scientifically correct answer to a given question and for this reason was seeking to understand Galileo's methodology. However, Raphael closes the chapter with an attempt to draw a paradigmatic picture of the *ideal reader* of Galileo based on recent historiography, and in particular on the – erroneous – representation of the features of the first commentators on the *Two New Sciences* as delineated by Domenico Bertoloni Meli in *Thinking with Objects*.[2] It must be noted however that Meli was not attempting to describe the ideal Galilean reader, but to present the responses and rebuttals – based on demonstrative arguments and experimentation – to Galileo's assertions in the field of mechanics provided by such prominent readers as René Descartes (1596-1650), Marin Mersenne (1588-1648), Pierre Gassendi (1592-1655), and Baliani himself. The characteristics of the *ideal reader*, who sought to verify Galileo's hypotheses on the mechanics of motion based on observation, experimentation, and a critical cross-reading of the sources (*Dialogue* and *Two New Sciences*), could be found only in Descartes and Mersenne according to Raphael, based on a copy of Galileo's work profusely annotated by Mersenne with diagrams and comments drawn from an analysis carried out by Descartes (as is discussed in the third chapter).

Above and beyond this conceptual oversight, we wonder why, if the aim of *Reading Galileo* was to go beyond recent historiography in its study of the reception of *Two New Sciences*, we find in it an analysis based on a category that is a key feature of that very historiography. Furthermore, if the application of a category of analysis to a real context provides almost exclusively exceptions, the validity of the category itself should be thoroughly examined. And even if her choice was dictated by the desire to clarify the inadequacy of the typology of the *ideal reader*, we won-

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[2] D. Bertoloni Meli, *Thinking with Objects. The Transformation of Mechanics in the Seventeenth Century*, Baltimore, The Johns Hopkins University Press, 2006, pp. 105-108.

der why the author has not attempted to develop a categorization that would encourage an organic reading of her results, which are in fact of immense interest. In our view the analysis should have been based not on the readers' acceptance or rejection of Galileo's research methods (a separate and still much debated historical and epistemological problem), but on the reasons that motivated those readers to study and annotate his works. In our opinion the great value of Renée Raphael's book resides in her having demonstrated through the careful study of this previously unpublished and in large part unknown material the great variety of approaches to the *Two New Sciences* adopted by Galileo's readers.

Another critical point in the present study resides in the author having identified, in their methods of interpreting Galileo's text, the failure of many scholars of the period to apply his modern scientific approach. A particularly clear case may be found in the second chapter, which Raphael dedicates to the copy of the *Two New Sciences* belonging to the last pupil of Galilei, Vincenzo Viviani (1622-1703):[3]

> Despite Galileo's and even Viviani's insistence on the novelty of Galileo's methods, his last surviving student relied on traditional approaches as he read and worked with Galileo's text [...]. Rather than using experiment or mathematics to extend Galileo's conclusions, Viviani applied a variety of older forms of reading strategies aimed at summarizing and extracting the key opinion and demonstration advanced by Galileo to other usable forms, whether marginalia or separate treatises (pp. 73, 74).

In this respect, using the typology of approaches to the scientific mentality of the Pisan scientist as elaborated by Paolo Rossi (1923-2012),[4] Raphael's Galileo closely resembles the figure drawn by Stillmann Drake – a measurer of time and distances who was little interested in philosophy and epistemology.[5] Of course there are other conceptual portraits, among them the Aristotelian Galileo of J.H. Randall Jr.;[6] Alexandre Koyré's Platonic Galileo, *mathematizer* of the universe;[7] and Galileo as prestidigitator and charmer, interested in corroborating his *Coper-*

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[3] BNCF, MS *Gal.* 79.

[4] P. Rossi, *Immagini di Galileo*, «Nuncius. Journal of the Material and Visual History of Science», 9,1 (1994), pp. 3-14.

[5] Cf. S. Drake, *Galileo at Work: His Scientific Biography*, Chicago, Chicago University Press, 1978.

[6] Cf. J.H. Randall Jr., *The School of Padua and the Emergence of Modern Science*, Padova, Antenore, 1961.

[7] Cf. A. Koyré, *Études d'histoire de la pensée philosophique*, Paris, Colin, 1961.

nican faith, as proposed by Paul K. Feyerabend.[8] Recent developments in the historiography of science have shown how these representations of Galileo are contradictory as well as complementary and, although every new interpretation can shed useful light, the adherence of Galileo's successors to his methods deserves separate discussion. Raphael's Galileo is the Galileo of the *Essayer*, who adhered to the scientific method and to theories elaborated as a result of repeated experimentation.

As a logical consequence, apparently considering the introduction of the scientific method to be the highest point and greatest innovation in the development of sciences, Raphael underlines the non-adherence, in this case by Viviani, to the "novelty of the Galilean method". However, the methodology presented by Galileo in the *Two New Sciences* differs in some important ways from that in the *Essayer*. As already shown by Bertoloni Meli,[9] the later work presented an axiomatic construction of a science of motion, and indeed in the first edition no proof was provided for the only stated axiom. The students of Galileo who first became interested in expanding and substantiating their maestro's hypotheses, even though they too were more interested in the axiomatic foundations than in experimental results, realized the limitations of the *Two New Sciences*. Thus Evangelista Torricelli (1608-1647) dedicated a section of his *Opera Geometrica* (1644) – the first work that he published after receiving the title of Mathematician of the Grand Duke – to the science of motion ("De Motu") and Viviani augmented Galileo's original text by adding to the first edition of Galileo's collected works (Bologna, 1655-6) a proof that he had worked out together with his master. In short – to paraphrase the philosopher Wolfgang Stegmüller – *to study the dynamic aspect of scientific evolution the logical method must be replaced by the historical method*.[10]

For this reason, alongside the analysis of the *scholarly practices* and *scribal technologies* of the readers of the *Two New Sciences* as provided by Renée Raphael, in our opinion a categorization of the reading goals should be made, sufficiently specific to include all the users of the Galilean text and at the same time broad enough to be applied to the reception of all those texts that, in the scientific field in the early modern period, presented themselves as harbingers of new methodologies and discov-

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[8] Cf. P.K. Feyerabend, *Against Method: Outline of an Anarchistic Theory of Knowledge*, London, NLB, 1975.

[9] D. Bertoloni Meli, *Thinking with Objects*, cit., pp. 117-120.

[10] Cf. W. Stegmüller, *The Structure and Dynamics of Theories*, Berlin-New York, Springer, 1976, p. 3.

eries – without prejudice to the fact that such a categorization should always be consequent to a solid historical-scientific interpretation of those texts.

We would suggest a tripartitioning of these reading purposes (underlining that in the present review this categorization is to be viewed only as an example, and therefore as neither comprehensive nor definitive):

(i) a reading for objective scientific purposes, aimed at obtaining new knowledge through the applications of various analytical methodologies (e.g., Marin Mersenne, author of *Les nouvelles pensées de Galilée*; and Pierre Gassendi, author of *De motu impresso a motore translato*);

(ii) a reading *a partis pris*, exploiting the material to attain other objectives, for example to confirm previous ideas through the skewed interpretation of innovative hypotheses, and therefore in no case aimed at obtaining new knowledge (e.g., the use of certain hypotheses and observations by Galileo as arguments in support of the Aristotelian school of natural philosophy, as brilliantly demonstrated by Raphael in the final chapter of her book, where she analyzes Jesuit teaching manuals from the second half of the 17th century);

(iii) a programmatic reading, in which new scientific developments are assimilated, but turned by the reader to his own uses – from the preservation and diffusion of the work of Galileo (e.g., Viviani) to the proving of the laws of motion through experiments, but then incorporating these discoveries into an Aristotelian framework (e.g., Giovanni Battista Riccioli and his experiments with falling bodies conducted between 1634 and 1650).[11]

Such a system of categorization, based on a strict historical analysis, implies an evaluation of texts by their readers and is extendible by the specimens of works annotated by other well-known men of science (the subject to which most of *Reading Galileo* is dedicated) to those same works when used as sources for subsequent productions (e.g., we know for a fact that one of the key sources for Gassendi's study of motion and his *De motu impresso a motore translato* was the *Two New Sciences*, even if we have no evidence of his having owned and annotated a copy of Galileo's text). These conceptual categories also allow us to characterize the methodologies of the various authors, especially those in the third category, which are often the result of personal and subjective choices

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[11] Cf. M.T. Borgato, *Riccioli e la caduta dei gravi*, in M.T. Borgato (ed.), *Giambattista Riccioli e il merito scientifico dei Gesuiti nell'Età Barocca*, Firenze, Olschki, 2002, pp. 79-118.

that may be quite distant from the criteria normally associated with the New Science. Viviani's reading provides a perfect example of the third category.

In Chapter 2 Raphael takes the copy of the *Two New Sciences* owned by Viviani and shows that he studied the text closely, re-reading it several times and following a specific procedure in making his notes; the margins are filled with corrections, alternative or supplementary proofs, and implementations of the iconographic apparatus. She concludes that Viviani's method of interpretation was both descriptive and critical, stating: "[...] *the continuities between Viviani's approach to the "Two New Sciences" and established textual practices also stand in contrast to Galileo's explicit rejection of traditional approaches*" (p. 52). Such an assertion seems to fail to take into account one of the intellectual endeavours that kept Viviani busy for the longest time and is in fact mentioned more than once by Raphael but only in passing (pp. 58, 61, 191): his never realized publication of a complete edition of Galileo Galilei's works. In the correspondence of Viviani from the period between the early 1650s to the death of the great patron of Galilean studies and founder of the *Accademia del Cimento*, Prince Leopoldo de' Medici (1617-1675), there are many references to the preparation of this new edition.[12]

Draft plans for other works, including a biography of Galileo, indices and Latin translations of those works originally written in the vernacular, have come down to us.[13] Raphael also studied Viviani's *Trattato delle resistenze*, published posthumously by Guido Grandi (1671-1742) in 1708, and the *Quinto libro degli Elementi d'Euclide* (1674). A historical reading of these allows us to hypothesize an application by Viviani of his *scholarly practices* to a critical edition that unfortunately was never completed and that would have been very different from the 1655-6 edition prepared by Carlo Rinaldini (1615-1698) and the Bolognese publisher Carlo Manolessi (1614-1661), to which Viviani contributed exclusively by providing copies of Galileo's writings and unpublished manuscripts and for which he reserved severe criticism.[14] The *persona* of Viviani observable in his correspondence is that of a disciple who remained loyal even after the death of his master, and who was engaged during his entire life in the dissemination of Galileo's work and in the celebration and preservation

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12 ODG, *Carteggio*, II, pp. 301-399 (*passim*).

13 A. Favaro, *Documenti inediti per la storia dei manoscritti galileiani nella Biblioteca Nazionale di Firenze pubblicati ed illustrati*, «Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche», XVIII (1885), pp. 1-112, 151-230: 20-22.

14 ODG, *Carteggio*, II, p. 321 (Vincenzo Viviani to Cosimo Galilei, March 21, 1656).

of his memory and legacy. It is an image closely linked to the principle of *auctoritas*, which was repeatedly disowned by Galileo himself but was extraordinarily present in works such as the *Quinto libro*, in which he is presented as a direct descendent of Euclid and, together with his students, as the heir of an ancient tradition of scholarchs (see p. 72). Here the contradiction is apparent rather than real. The ideals of the New Science are not denied or suspended; instead discoveries, demonstrations and hypotheses coexist inextricably with the very human portrait of a master considered to be irreplaceable by his last living student.

Regarding the concept of *novelty* in the work of Galileo and his readers, two of the copies analyzed in the third and fourth chapters of *Reading Galileo* are of great interest: one of the two belonged to Marin Mersenne [15] and another belonged to the mathematician and astronomer Seth Ward (1617-1689), one of the original members of the Royal Society.[16] In both there are extended annotations, including the symbolic re-writing of portions of the text that describe geometric demonstrations, and both readers propose innovative *translations* in alternative mathematical languages. Mersenne, a scholar of musical theory and an attentive reader of Descartes' innovations, opted for a large number of diagrams, whereas Ward worked in algebraic re-writing. Ward was a pupil of the mathematician William Oughtred (1574-1660), who introduced algebra in England in 1631 with the publication of the first edition of his *Clavis Mathematicae*, a treatise based on the work of François Viète (1540-1603).

In this regard, a first methodological consideration can already be made; the alternative devices to Galileo's prose description used in these copies do not, in our opinion, imply that Mersenne and Ward were not interested in exploring the validity of Galileo's assumptions (as proposed by the author, p. 129). Indeed, one may argue that it was precisely in order to better grasp the nature of Galileo's hypotheses that parts of his text were reduced to *lectiones* that was more congenial to the reader in question, as well as being methodologically similar to the new ideas that were spreading in his academic environment. With his more rigorously scientific attitude, Mersenne's principal interest (unlike Viviani) was not to disseminate the work of Galileo by preparing a learned critique aimed at enhancing, correcting or implementing the hypotheses and discoveries of the master, but to directly pursue scientific knowledge through the

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[15] Bibliothèque Sainte-Geneviève (Paris), 4V 585 INV 1338 RES.

[16] Bodleian Libraries – Savile Collection (University of Oxford), shelfmark Savile Bb.13.

treatment of specific topics, taking Galileo's discoveries and presenting them in a new and organic fashion. Thus Mersenne's annotations were a form of reflection and the working out of ideas for his own works, such as *Les nouvelles pensées* (see p. 87). From a methodological point of view, Galileo replaced Aristotle in the scientific approach of Mersenne, serving as the scholarch of a new teaching tradition, but shorn of the mantle of *auctoritas*:

> What stands out from the surviving records of Mersenne's scholarly practice is his desire to put Galileo in dialogue not with the ancient tradition but with the members of his own circle. Mersenne created a world of textual scholarship that privileged the close reading of and commenting on texts but whose points of reference were modern authors, not ancient ones (p. 84).

Thus a practice was established in textual analysis and in related scientific investigations – both theoretical and experimental – a practice that can be observed in Ward and in the scientific circle that preceded the creation of the Royal Society – the Oxford Philosophical Club. Textual study was systematized and used as an instrument to design experiments that would confirm or refute hypotheses and produce new knowledge. Unlike Mersenne, however, it is plausible that Ward wrote some of the notes in his copy of the *Two New Sciences* while pursuing his preliminary study of the subjects covered (and thus we find in the margins of the pages calculations reported in full, supplementary or alternative proofs, etc.) and other notes after having conducted his own experiments on those problems that were of particular interest to him (at least in those cases in which the will to conduct them was manifested or it was physically possible to do so). Another difference between Mersenne and English scientists like Ward was the interest reserved for the presenter of the hypotheses investigated, tested and criticized. While both provide examples of readings for objective scientific purposes, Mersenne's *Nouvelles pensées* fueled a clash between different schools of thought and led to the drafting in 1643 of a reply in the form of a letter from the "Mathematicians of Paris" to the supporters of Galileo in Italy (see pp. 87-90), whereas the Oxford Philosophical Club focused on the reading of texts as sources for subsequent experiments aimed at confirming or refuting hypotheses, without creating outright opposition between different methodologies or lines of research.

The fifth chapter is dedicated to the early modern academic system's response to the discoveries and hypotheses of Galileo through the paradigmatic example of the dispute between factions within the University of Pisa during the second half of the 17th century in which, as the author

rightly points out, the opposition between old and new schools of thought tended to manifest itself in the exasperated tones of a rhetorical battle more than in the works produced by opposing factions. Curious examples of eclectic Aristotelianism emerged both from the ranks of those opposed to the neoteric methodologies and among the neoterics themselves.

Among those who undertook the research line of the *Aristotelization* of Galileo was the philosopher and physicist Claude Bérigard (1592-1663), professor of natural philosophy first in Pisa and then in Padua. Motivated by the desire to preserve the philosophical system of Aristotle, still widely considered to be the only one capable of presenting a coherent picture of reality, Bérigard may be counted among those who were convinced that the ideas and hypotheses produced by the New Science could be appropriated and used by the Aristotelians, which was in fact one of the distinctive features of eclectic Aristotelianism. Thus, in his *Circulus Pisanus* (particularly in the second edition of 1661) Bérigard pursues his own idiosyncratic program of scientific updating, but since his work was aimed at safeguarding the Aristotelian system of thought, he confines himself to choosing individual cases, hypotheses and experiments that would support or refute opinions on the basis of the Stagirite's teachings. This is a typical case of reading *a partis pris*; however it should be remembered that there were also cases, for this category, that were not necessarily tied to the teachings of Aristotle.

A clear example of this alternative attitude is the treatise on practical geometry by Vincenzo Renieri (1606-1647), which was intended for scholastic teaching but never actually published.[17] Renieri, who was a correspondent and disciple of Galileo, became a professor of mathematics in Pisa in 1640. He wrote his treatise using the *Two New Sciences* as a source for the preparation of geometrical problems as exercises for his students. A further example of the use of Galileo's text for didactic purposes is the unpublished *Physica*,[18] written sometime after 1706 by the philosopher and physician Pascasio Giannetti (1661-1742). Giannetti first taught logic and philosophy, and then medicine (beginning in 1706) at the University of Pisa. He was a follower of Galileo and one of the editors of the second edition of Galileo's collected works, which was published in Florence in 1718.

In Giannetti's *Physica* Raphael sees some of the characteristics of the *ideal reader*, such as the use of cross-referencing between *Dialogue* and *Two New Sciences*. In a section of *Physica* dedicated to accelerated mo-

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[17] BNCF, *Gal.* 114, leaves *33r-77r*.

[18] Biblioteca Medicea Laurenziana, *Giannetti, Physica*.

tion, Giannetti presents Galilean hypotheses, such as the odd numbers rule, as proven theories that did not require further demonstration or explanation. There is, in our opinion, a precise and completely logical reason for this; by the time Giannetti wrote *Physica*, most of Galileo's assertions had been thoroughly tested and either proved or disproved. Both then and now in the teaching of physics, when knowledge is certain it is not considered necessary to provide a proof or demonstration in support of its veracity; one may limit oneself to the exposition of the law. Moreover, time – nearly 70 years separated *Physica* from the *Two New Sciences* – as well as experimentation have allowed Galileo's discoveries to be arranged and classified so as to allow cross-references between his various works.

The chapter ends with a careful analysis of how, in addition to the basic methodological differences between the Aristotelians and the neoterics, the debate among the professors of Pisa assumed the form of an accumulation of expedients aimed at discrediting the adversary and as a consequence constructing the image of the intellectual enemy. Here divisions were exacerbated by mounting rhetoric rather than scientific practice (see p. 161). The comments of one of the most conservative professors at the University of Pisa, Giovanni Maffei, bear witness to the fear of many that the abandonment of the Aristotelian methodology would lead to public and political destabilization:

> When professors publicly challenged Aristotle in the lecture hall, in their writings, and even in print, they neglected to consider the "gravità magistrale", or the weight of their position as professors [...]. Disputations in which participants disagreed about the fundamentals gave rise to a great desire to continue debating, but these encounters sowed discord, not only among the teachers but also among the students, each eager to defend his master. Maffei makes clear that what was at stake in the debate was not the best way to arrive at philosophical truth but the content and approach that were most appropriate and useful for training students as future scholars, perhaps, but also as members of a common religious and political community. It was true, Maffei argued, that his opinions could be countered by individuals who claimed that in this profession one must seek the truth, not what was useful. Such an enterprise was valid, he wrote, when one engaged in a philosophical dispute. Yet, he continued, university teaching was intrinsically tied to "public interests and political debates," and as a result, one needed to proceed differently. The goal was to determine not which doctrine was truer but which one was most becoming to the "tranquillity of the State, the peacefulness of the people, and good political and civic governance." In short, it was not precisely the content and methods of the innovators that provoked concern; it was the way these individuals chose to transmit them in the university setting (p. 162).

In this respect, it would be interesting to investigate what was done by academic officials in the attempt to stem and resolve the conflict. This point is passed over in Raphael's book, but we can offer at least one example that shows a rare pragmatism, perhaps motivated by the desire to augment the university's prestige but also by the sincere wish to resolve an issue that was becoming more and more bothersome. Giovanni Battista Quaratesi, who served as *Provveditore* (University Administrator) in the early 1660s, proposed the creation of a chair of Galilean studies in 1662: "[...] *not with disdain for Aristotle, but for the desire to know where mistakes were made, to recognize the truth and to show how Tuscany too has its Plato and its Aristotle*," a suggestion that must have aroused controversy and in the end had to be relinquished.[19]

The sixth and last chapter of *Reading Galileo* is certainly one of the best in the book. Here the author discusses the reception of Galileo's ideas among the Jesuits and the use of Galileo as a source of material for the teaching manuals being prepared for the Jesuit colleges. Raphael undertakes a thorough analysis of various works that have largely been ignored by historiography and presents the methodology by which the absorption of Galilean texts by the Jesuits progressively reduced the work of the Pisan scientist to a textual authority, glossing over his experimental method and retrofitting his hypotheses for the *Ratio studiorum*. Furthermore, the author suggests that the phase involving the progressive take-up of Galilean ideas was preceded by a period during which members of the order conducted their own experiments under careful supervision. However, when faced with the confirmation of Galileo's hypotheses, they 'adapted' his hypotheses and demonstrations, at least for teaching purposes, favoring the diffusion of notions based on partially erroneous assumptions such as a law of falling bodies based on the average velocity between time intervals rather than on the instantaneous velocity. This version was stated for the first time by Nicolò Cabeo (1586-1650) in his *In quatuor libros Meterologicorum Aristotelis Commentaria* and can be found in all the Jesuit manuals produced in the period immediately following its publication in 1646. Another example is the reinterpretation of Galileo's theories in line with the Aristotelian methodology, such as the theory of motion proposed by Giovanni Battista Riccioli (1598-1671) that conserved the notions of *levitas* and *gravitas*

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[19] [...] *non con livore contro Aristotile, ma per zelo che si sappia dove si sia errato, si ritrovi la verità e si riconosca che anco la Toscana ha il suo Platone et il suo Aristotile.* Archivio di Stato di Pisa, *Università 2*, G 78, leaves 85*r*-90*v* (*Proposte del Provveditore Giovan Battista Quaratesi per l'anno accademico 1662/3*).

(pp. 173-174). Thus, in Jesuit colleges, which continued to teach Aristotelian natural philosophy, Galileo's teachings were included (in bowdlerized form) or excluded from the curriculum on the basis of the judgement and didactic ends of the teachers:

> The insertion of the Two New Sciences into classroom teaching of philosophy reveals why and how a group of readers committed to traditional scholarship read and refashioned the book to make it appropriate for their students. Galileo's gestures toward standard philosophical topics encouraged discussion of it, especially because Jesuit teachers were enjoined to maintain high standards of scholarship. The techniques they applied to read and write about the Two New Sciences were similar to those used by readers at Pisa and elsewhere. Jesuit professors read the Two New Sciences for the sections that touched on their expositions of Aristotle and with the scholarly methods of their discipline, largely ignoring the book's mathematical sections and proofs. The textual nature of their own scholarly practice, in turn, provided a ready mechanism for the domestication of the troublesome text, as the problematic elements of the Two New Sciences – its reliance on experimentation and quantification – were transformed in these textbooks into textual claims to be put in dialogue with established authorities (p. 188).

In conclusion, although we find ourselves in disagreement with many of the conceptualizations put forward by Renée Raphael, our overall judgement of *Reading Galileo* is substantially positive. The author has scrupulously analyzed little known sources whose importance has been unjustly underestimated, interpreting the material with rare and profound linguistic and scientific competence. Moreover she underlines the need to delineate a historical study of the interpretation, dissemination and reception of the texts, complementary to the more usual investigation of the philosophico-epistemological genesis of intellectual production, which has always formed the core of research on the history of science.