Introduction

Galileo's Reading developed around Galileo Galilei's (1564–1642) frequent claims in his philosophical texts that he was playing the part of one of the Christian knights in Ludovico Ariosto's (1474–1533) Renaissance masterpiece *Orlando furioso* (1516, 1521, 1532). The studies in this book show that Galileo methodically and consistently incorporated the literary elements from his favorite poem and similar works into the philosophical arguments he championed. This authorial choice intersects with issues of wider concern in the seventeenth century: the definitions of truth and fiction, the interdependence of philosophy and poetry, reader reception in both specialized and courtly audiences, and the generation of knowledge. *Galileo's Reading* brings Ariosto's and Torquato Tasso's (1544–1595) Christian knights, pagan warriors, and ferocious monsters face to face with the Paduan Aristotelians, Jesuits of the Collegio Romano, and the fictitious interlocutors in Galileo's final works. By chronologically considering specifically the appearance of epic poetry within Galileo's entire corpus, this book compares the fictional works Galileo read with the subsequent literariness of his writing, uses the material history of Galileo's library to examine the interplay of natural philosophy and epic poetry in creating knowledge, and suggests a more widely based literary and cultural genealogy for Galileo's new epistemology than that previously considered by scholars.

The conflicts in which Galileo was involved erupted during a fruitful period of innovation and interdisciplinarity, making the identification of key terms a necessity for any discussion of the fields in which he operated. Learned men like Galileo wore many complementary hats: mathematician, poet, astronomer, dramatist, philosopher, artist, and scientist. Accordingly, finding a tidy label for Galileo and his associates is problematic. When Galileo moved to the Medici court in Florence in 1610, he asked to be called a mathematician and philosopher, that is, an intellectual who used geometric and numerical demonstrations to inform hypotheses

about the causes of natural phenomena generally described in terms of dialectical, logical reasoning. For that reason, I will refer to Galileo as a mathematician, philosopher, or natural philosopher. His opponents also distinguish the territory of these fields from astronomy, making the terms critical to an identification of the presumed conventions of practitioners in these disciplines.

Operating hand in hand with philosophical best practices are also Galileo's concerns with the role of the literary in this new paradigm. In many ways the literary was precisely what Galileo was working against with geometric, numerical, and logical analysis. Literary language continues to be constructed in such a way as to invite, if not necessitate, multiple interpretations of the author's text. The literary points to not just one physical objective reality of the kind that Galileo was trying to describe, but many. These include the traditions of the genre, the need to ingratiate a princely or imperial court, establishing symbolic or allegorical claims about society and the human condition, and presenting models of behavior for readers. Thus, while Virgil's verses can accurately describe the received tradition of the movement of constellations, the language in which the poet expresses that idea is suspect (to Galileo) owing to its role in the much larger, subjective project that is the *Aeneid*. According to Galileo's perspective, descriptive terms were not necessarily chosen for their direct correspondence to an object or phenomenon, but to satisfy requirements of meter, form, and style in the service of the literary elements listed above. His preference for things, *res*, has been well documented by modern criticism, but the mechanism for his success was still dependent on a tradition of words, *verba*.[1]

Because the implications of the Copernican reconsideration of the place of the Earth in the heavens were so dramatic, so too was the opposition. Since the means of expression of these ideas were critical to the success or failure of Galileo in intellectual debates of the period, literary models and sources became catalysts in the acceptance of a philosophical idea. Authors in these debates speak widely of the philosophy and poetry that inform their theories. This is an era in which Tycho Brahe (1546–1601), famous for his compromise solution to the Copernican–Ptolemaic debates, could claim that the Book of Proverbs was written by "Poetae."[2] Pliny's prose *Natural History* was as authoritative on matters of natural philosophy as the verses of Virgil's *Aeneid* and Lucan's *Pharsalia*. For that reason, "poetry" in *Galileo's Reading* will refer to verses indicated as poetry by the authors of these works. Epic poetry and the epic project are specifically poems depicting large-scale conflict often written with the intent

of providing a foundational narrative to glorify the poet's patron. For the period, the interconnection of poetry and philosophy is not novel, but Galileo's particular meditated and evolving incorporation of epic poetry into his philosophical prose is.

In other contexts, recent interdisciplinary studies have offered partial solutions to this consideration of the mutual influences of philosophy and literature including poetry. New, bizarre, or otherwise intriguing discoveries about the natural world had been popular fodder for poetic and prose-fiction writers in many cultural contexts. In *Galileo's Glassworks*, Eileen Reeves provides a history of lenses and mirrors in literature that included a sizeable group from the early epic and romance traditions: the ancient cycle of stories *Romance of the Seven Sages*, Gower's *Confessio Amantis*, the tournament chronicles *Chroniques de Tournoy*, the anonymous French chivalric poem *Roman de Renart Contrefait*, the medieval French romance *Cleomadés*, the Carolingian cycle on the sack of Rome *Destruction de Rome*, the medieval Grail story *Parzival*, and the later French *Romance of the Rose*.[3] Reeves has observed that optics in these literary contexts are frequently tied to the rise and fall of empire; often to the victors belonged the technology.[4] In Patrick Grant's study of method in the English Renaissance, he argues that the development of method in philosophy modeled by Francis Bacon (1561–1626) challenged poets to renew their investigation of the relationship between fictive images and the truth.[5] Isabelle Pantin has shown how French poets of the sixteenth century used Plato, Apollonius of Rhodes, the Bible, Giovanni Pontano (*c.* 1429–1503), Marsilio Ficino (1433–1499), Philipp Melanchthon (1497–1560), and Tycho Brahe as sources and inspiration for a poetry that reflected prejudices, illusions, experiments, and debates otherwise reported in treatises of the period.[6] In the case of Jean Edouard du Monin's *Uranologie* (1583), the poet broke with Aristotle as an authority on comets and subsequently adopted Seneca's *De cometis* as his primary text of engagement.[7] This rupture suggests that some poets were attuned to ideological shifts in the philosophy of the period and accordingly exercised discretion about their sources for inspiration. But what of the philosophers who turned to verse for everything from allegorical structure, to rhetorical flourish, to examples of word usage and descriptions of natural phenomena? More pressing still, what of authors such as Galileo who manipulated the literary qualities of these poetic sources in order to craft a philosophical argument?

At the most accessible level, philosophical texts turn to poetry for didactic reasons. Quite simply, verse was (and remains) a tool for memorization. Work by Francis Yates and Lina Bolzoni has demonstrated Renaissance

readers' use of mnemotechnics, the practice of committing to memory large amounts of information.[8] Verse played a role in this skill. Mnemonic verses were used to teach syntax and grammatical rules, or became part of larger memorization schemes. French philosopher and follower of Galileo, Pierre Gassendi (1592–1655), includes several mnemonic verses in his works on various mathematical and astronomical topics. One such example is the following Latin couplet: "Livor, mente latens insultat honoribus, horret / Grandi gesta, harens insigni laude notates."[9] The translation of these verses is less important than what the words represent in the mnemonic scheme. Each of the twelve words corresponds to one of the twelve months of the year in chronological order: *livor* is March, *mente* is April, etc. Using this information, the words are used to determine how many days of each month are spent in a given zodiac sign. The first letter of *livor* is the tenth in the alphabet, and there are thirty-one days in the month of March. Thirty-one less ten makes twenty-one, leaving twenty-one days under the sign of Aries in March.[10] This kind of quick aid for factual recall is not subjective, figurative, argumentative, or literary. The words are mathematical indicators, the meter a vehicle for memorization.

Verse was also a means for transmitting material with educational and informative value on a much larger scale. Classical didactic authors such as Aratus, Manilius, and Lucretius wrote their encyclopedic works of natural history in epic hexameter, and early modern philosophers frequently excerpted from those texts in their own books. Authors of classical epic poems such as Homer, Virgil, and Lucan were also cited for their statements on natural phenomena as though they were witnesses to these events rather than transmitters of classical literary expression. This is a use of the literal meaning of these poems. Galileo raises his first objection to his detractors' texts because of this poetic testimony and he will turn that practice against its practitioners by exploiting the literariness of those same sources.

Aside from being factual sources and memory aids, poets were also models for rhetorical moves that could assist an author in clarity, persuasion, or both. Studies have shown that other early modern philosophers incorporated verses into their texts in a structurally significant way. The premise of Brian Vickers' work on Francis Bacon is that the fascination created by Bacon in his own time was not just the result of his science, but also his prose. Through close linguistic analysis, Vickers connects the rhetorical structure of Bacon's prose to his method, demonstrating the powerful interpretative combination of the two. For example, Bacon's frequent use of analogy often results in magnifying the object originally under

discussion.[11] Elizabeth Spiller points out that Robert Boyle (1627–1691) read *Amadis de Gaule* and *Orlando furioso*, and was himself aware of the influence of the poems' wandering narratives on his thought and writing.[12] These are stylistic elements with roots in poetry.

Galileo's Reading proposes to identify the literary discourses, not just the rhetorical flourishes, active in the conflicts between Galileo and his opponents. Recent scholarship on the early modern period has established both the philosophical and literary as sites of knowledge production by arguing that the practices of both disciplines emerge from the premise that knowledge can be made rather than found.[13] Galileo would have readers believe that he provides found information about the natural world, but he must also make a new philosopher willing and able to find it. By revealing these strategies of making the new philosopher, my analyses shed light on the larger question of the interaction of these two means of expression without subjugating the one, poetry, to the needs of the other, philosophy. Galileo's effective use of analogy has been well studied, as has his highly praised syntax, and digressive dialogue structure, but when seen in light of his explicit use of verses that I analyze, the breadth of this literary attack on his opponents becomes apparent.[14] The combination of his passion for reading and annotating authors such as Ariosto and Tasso (along with dozens of other authors of epic poetry) with the frequently vivacious defense of his philosophical ideas suggests a natural pairing that nonetheless has gone unanalyzed. *Galileo's Reading* examines the specifically literary nature of these elements to reveal a complex project of textual one-upmanship played by the Tuscan philosopher and his opponents.

For Galilean studies, the context and import of this relationship between literary and philosophical discourses in the conflicts of the late sixteenth and early seventeenth centuries have been concerned primarily with the overlap between the very structures of reasoning and communicating: dialectic and rhetoric. Both disciplines were at the fore of publications in Galileo's lifetime, both with roots in Aristotelian philosophy.[15] Traditional logical investigation for determining the causes of natural phenomena typically involved syllogistic examination of known true principles related to them. When those true statements were elusive, dialectical reasoning furnished the means for arriving at an apparent truth by using principles commonly held to be true. This use of common opinion fundamentally unites dialectic and rhetoric.[16] The probable and the persuasive form a powerful alliance for determining what seems to be true.[17] I argue that Galileo moves poetry out of the realm of fact-bearing vehicle of tradition and into the world of the probable via his strategy of revealing

the literariness of its language. Notably, this strategy calls attention to the tenuous link between objects in the physical world and the words used to describe them. At the same time, the literary space allows Galileo to craft the person of the philosopher using the persuasive force of rhetoric and the creative capacity of the literary to bring him (because these are overwhelmingly men) most fully to life in his final works.

The aim of these allied forces of philosophy and literature was to promote a hypothesis about what Fernand Hallyn has called the *mythos* or *poesis* of the natural world. This kind of *poesis*, or making, stands in sharp contrast to that of the plastic or visual arts, a distinction that Galileo will repeatedly draw in his works when he compares his opponents' work to marquetry, paintings, and collages.[18] According to Hallyn, the very actions of proposing probable truths about the natural world involve accessing or recreating a divine poetics of the natural world.[19] Galileo, through mathematics, embraces that optimism of revealing the structure of the natural world. Through a literary epistemology he establishes a *poesis* of the new philosopher. For further epistemological connections, we might look to Cristoforo Landino (1424–1504), whom Galileo would have known through his commentary on Dante's *Comedy*. In that commentary he explores the demarcation of making and creating:

> The Greeks said "poet" from this word *piin*: which is in the middle between "creating," which is appropriate to God when out of nothing he brings something forth into being, and "making," which is appropriate to men when in any art-form they compose out of matter and form. Therefore, although the figment of the poet is not completely out of nothing, yet it departs from "making" and comes very close to "creating."[20]

Philosophers who construct a world become poets. For Copernicus and Kepler, this involves the instruments of rhetoric and dialectic: an inventory of topics, intertextual insertions that expose a network of relationships, and tropological analysis. Instead, Galileo, while he still adopts those Aristotelian elements of investigation to explain this *poesis*, also develops a means of incorporating literary poetics to aid his arguments.

Moments of textual criticism against an author's presentation of theory are the instances in which Galileo is most likely to cite from epic poetry, make reference to fantastical monsters, resort to a language of chivalric combat, or declare that his own work is a poetic fiction. This should not be a surprising connection, since the practices of both philosophical and poetic *poesis* were hermeneutically intertwined and the humanist project at the base of each was, after all, one founded on textual analysis.[21] Rebecca Bushnell describes reading for the early modern humanist in an apt way

for imagining the approach to classical poets by these philosophers that will be outlined in Chapter 1: "harvesting or mining of the book for its functional parts – useful to borrow for the reader's own writing or to serve as practical conduct rules or stylistic models."[22] Texts written by authoritative authors then, to use Bushnell's terminology, were veritable mines for facts, phrasing, and form, as suited the purpose of the discerning reader. The contemporary method of commonplaces – that is, copying out and categorizing passages based on their rhetorical, dialectical, or informative value – was also an integral part of the natural philosophical writing of the period, what has been called: "a seemingly unending cycle of textual selection and assessment."[23] Galileo's opponents could thus use Tasso as a witness of an eclipse as easily as they could for a spirited alliterative verse. To establish the paradigm for the new philosopher to follow, Galileo instead will turn to poets to evoke literary tradition, courtly practice, and exemplary behavior, not as piecemeal models for style or pleasing ornaments.

Determining and validating an authoritative source for these aims involved similar techniques in the disciplines of philosophy and literature. For example, in Anthony Grafton's outline of Leon Battista Alberti's (1404–1472) reading process, he identifies certain humanist techniques that I would argue are the same ones that informed Copernicus' *De revolutionibus* (1543): "collation of witnesses, the setting of testimonies into their proper chronological order, and the denunciation (and explaining away) of scribal error."[24] As is well documented, Copernicus contrasted close readings of traditional works of geocentric philosophy with star charts generated on the assumption that the Earth rotated around the Sun.[25] Using this approach he pointed out the inconsistencies of the Ptolemaic theory of the structure of the universe for predicting planetary and stellar motion. By presuming that the Earth moved around the sun, the resulting charts were far more accurate in their accounting for the movement of celestial bodies. The selection of a poetic source involved the same textual challenges. Practices in both epistemologies include seeking out patterns of copy error, establishing the individuality of each manuscript, considering every version to compare possible errors, searching for ancient confirmation, making provisional readings, and separating criticism from hermeneutics.[26] Galileo applied similar critical reading strategies to both Aristotelians and the most popular poets of the period.

The *poesis* of these philosophers created a proliferation of printed materials that both aided and hindered fact-finding. The disparity of learned opinions on a topic destabilized monolithic truth claims and invited renewed investigation. As Grafton succinctly states about the relationship

between books and the development of new ideas: "The laboratory could not exist without the library."[27] Such disagreement came into sharp focus as printed volumes made the direct comparison of theories and measurements available to a wider reading public. This world in print comes under much scrutiny in Galileo's dialogues as his interlocutors compare it to the physical world around them. Already recognized by Erasmus (1466–1536) and others in the period, the problem of books in the late Renaissance was twofold: the overwhelming quantity of material to read, and the recognized power of words to persuade and deceive, if not edify.[28] The particular choice of poetic authority amid this crowd of authors was, then, considered and meaningful. Galileo's interlocutors navigate through this sea of books, and the hermeneutical choices they make reflect their characteristics as philosophers and as literary figures.

Because the Copernican controversy was based on reading, either of books or of natural phenomena, and because reading was such a personal endeavor, the identities of the reader and the author come to the foreground in these debates in a way that Galileo will exploit by turning to the literary elements of poetry where his opponents turned to it for fact. The personal, individual nature of criticism in the early modern period views an individual text as the direct result of historical conditions, which allows for the general criticism of the authority of the text itself.[29] Moreover, through an author's repetition or imitation of the art of the past, his or her art becomes an obvious product of human craftsmanship and therefore open to a critique of its authority for truth claims.[30] Already in Alberti's work, Grafton sees this implicit program of overturning classical predecessors in the Renaissance revival of Latin texts.[31] As more competing voices enter into a conversation, the authority of a single one diminishes. For example, such confusion permits the Jesuit Paolo Donati to de-authorize Plato and others as viable resources in a 1575 work on celestial motion that Galileo owned: "if Plato were of this opinion, that it is certain that the stars move themselves on their own, then even in this he deceived himself. Who doubts the lies of Herodotus, being esteemed by everyone a fantastical [*favoloso*] historian? And Pomponio Mela does not tell this as a true thing, but as very marvelous and impossible to believe."[32] While discussions of Galileo's Platonism persist in modern scholarship, Aristotle remained the figure with whom most of his contemporaries and he himself contended in written work and public debates.[33] If such an authority as Aristotle could be contested, then the philosophers of the day were equally open to attack. Galileo was not willing faithfully to accept the authority of someone else's written account, whether philosophical or

poetic. He balked at reading citations of poetry as presentations of facts about nature in the works of other astronomers and philosophers, which allows a discursive opening for the creation of a new authority, a new philosopher, crafted, as it were, in literary terms.

In the dialectical reasoning as well as the persuasive rhetoric that underlie the two epistemologies at work in establishing this new paradigm, the importance of the word cannot be understated. Words themselves needed to be defended from attack. According to Grafton, Leon Battista Alberti "picked his Latin words and phrases with a watch-maker's delicate precision from a wide range of sources, some of them newly discovered."[34] Galileo accordingly collected as many contemporary volumes on a subject as he could and also collected their source texts to conduct comparative readings.[35] For this reason, *Galileo's Reading* draws its comparative texts from books that were in Galileo's library and that he likely read. Since he heavily annotated volumes of poetry, mathematics, astronomy, and philosophy, and since he was frequently sought out for his opinions on matters of both poetic and philosophic interest, his comments on the acts of reading, interpretation, analysis, and drawing conclusions provide the most fruitful moments of intersection for *Galileo's Reading*. His collection of books establishes the tradition and, in some cases, also the negative model for literary and philosophical writing. His bookshelves represent Bushnell's humanist mine for form and phrasing. Returning to such territory is important because the Copernican controversy reflects problems of interpreting words as much as it does problems of interpreting the physical world – that is, the *res* and *verba* dichotomy of such importance to Galileo. As Lisa Jardine states in the contemporary context of Francis Bacon, dialectical reasoning requires "analysing natural relations as embodied in discourses, and manipulating language to gain insight into the natural world."[36] In a complementary way, by looking at the debate on the characteristics of the Moon's surface, William Shea summarizes the importance of analogy and metaphor in the early seventeenth century: "To see more, scientists had to see otherwise."[37] Galileo's library itself is a testament to these practices. In *Galileo's Reading* nearly every example of how authors approached matters of fact and designed their literary language is taken from a book Galileo owned.

In many ways the collection reflects the ideals outlined by Gabriel Naudé in his prescriptive *Advice on Establishing a Library* (1627). Naudé insists that book owners seek out many authors on one topic, both the principal authors and commentators, modern and ancient alike.[38] Galileo's collection shows the wide range of voices that compete for authority in

debates on the mountains of the Moon; the satellites around Jupiter; sunspots; floating bodies; and, of course, heliocentrism. In this way his library is similar to many of his contemporaries, though the uses to which he put it can be categorized along a spectrum. At one end can be found Galileo's friend, the abbot Orazio Morandi, whose collection in the service of Santa Prassede was subject to investigation by Inquisitorial authorities.[39] At the other end, one might look to the princely collection of Federico Cesi (1585–1630), founder of the Accademia dei Lincei into which Galileo was inducted in 1611, whose personal library of several thousand books and manuscripts became the foundation for that organization's research.[40]

Modern research on other philosophers has primarily focused on their figurative speech, with fruitful conclusions about the role of language in intellectual investigation. Again in reference to Bacon, Jardine's and Vickers' research has shown the range of rhetorical devices that Bacon employed with his new sense-based methodology: parable, *exempla*, apothegms, and proverbs, to name a few.[41] Bacon's *exempla* fall into distinct image groups: building, journeying, growing, and illuminating.[42] For example, as Bacon explains his intellectual journey to readers, the paths to knowledge need to be cut, or are blocked, or he simply gets lost along them. The sea voyage imagery is equally fraught with peril as his ideas face metaphorical shipwrecks and storms.[43] Hunting metaphors are another common motif in early modern natural philosophy.[44] William Eamon, primarily in the context of Bacon and Hooke, ties the hunting metaphor to the princely court and the new cultural ideals of the period.[45] For Galileo, such rhetorical choices are not merely flourishes or occasional gestures to the court, but work together to create a rich literary text of philosophy.

The particular focus of these literary elements on images of epic conflict is emblematic of fundamental courtly ideals and also carries with it distinct ties to Galileo's habits as a reader, his dislike of poetry in philosophical works, and even modern critics' descriptive language for the conflicts in which he was involved. This genre is tied to the princely court from its foundations in a way that was recognized by practitioners of natural philosophy prior to Galileo. In the dedicatory letter of Peter Apian's *Cosmography* (1584), the editor Johannes Bellerus writes to a group of noble adolescents: "indeed literature everywhere sets forth as testimony in famous records the exploits of the highest princes and heroes: just as Mathematics is useful and necessary to the understanding of the *Cosmographia*."[46] The study of letters and mathematics will create the ideal blend of studies for these young nobles. At first Galileo adopts similar