

Il Vasari nel libro della vita di Michelagnolo  
 stampato da Giunti in Firenze nel 1568. in 4<sup>to</sup>  
 a faccia 774 col; dopo lunghi racconti, scrisse di lui  
 7) con conosciamento grandissimo fece testamento di due parole  
 7) che l'anima sua non neke man di Dio. Il suo  
 7) corpo alla Terra, e l'anima a Parenti suoi prossimi  
 7) imponendo a' suoi che nel parlar di questa vita gli  
 7) ricordassino il padre di Gesu Christo.  
 7) O' così a 17. di febbraio l'anno 1563. a ore 23.  
 7) a un Fiorentino, che al Romano sarebbe 1564  
 7) spirò y irrone a miglior vita —

Ch'auent a faccia 717. col. parla della nascita di Michelagnolo  
 nacque dunque un figlio molto bello e forte che fu  
 nel mese di novembre l'anno 1474  
 a Lodouico di Leonardo Buonamici. di nome di Pietro,  
 secondo che si dice della nobilita e antichità famiglia  
 de' signori di Padova, essendo egli profeta, non haano del castello  
 di Pisa, e appreso uideo a' suoi della buona dove Francesco  
 uicario de' Reali. di cui si narra, nacque da un figliuolo  
 il detto di' di' malto la doppenza intorno all'otto ore di notte  
 al quale uoto come Michelagnolo —

Figure 1. Galilean MS 11, folio 168r, with the excerpt of Vasari's life of Michelangelo in Viviani's handwriting in the top half. Vasari relates mistakenly that Michelangelo died on 17 February. Viviani, however, was aware of the mistake (see note 44). Courtesy of the Biblioteca Nazionale Centrale, Florence.

# Viviani's Life of Galileo

By Michael Segre\*

IN 1654, TWELVE YEARS after Galileo's death, Prince Leopold de' Medici (1617-1675)—the brother of the Tuscan grand duke and the patron of Tuscan science—asked two people who had had direct contact with Galileo, Vincenzo Viviani (1622-1703) and Niccolò Gherardini (d. 1678), each to write a sketch of his life. Viviani and Gherardini had assisted Galileo in his old age: Viviani—"Galileo's last disciple," as he called himself—had been his amanuensis and assistant, and Gherardini was the curate of the *prioria* of Santa Margherita a Montici, in the neighborhood of Galileo's house, and had paid him regular visits.

Viviani's and Gherardini's reports were published posthumously, in 1717 and 1780, respectively, and were later (in 1907) included in Volume XIX of the National Edition of Galileo's writings. Thanks to Viviani's fame as a scientist and as a leading follower of Galileo, his sketch was for many years—practically until the end of the last century—the main source for later biographers. Gherardini was unknown, and his account was almost entirely overshadowed by Viviani's.<sup>1</sup>

Viviani initiated the historiographical tradition that presented Galileo as the first true empiricist, and his essay entitled "Racconto istorico della vita del Sig. Galileo Galilei," emphasizes the empirical and practical aspects of Galileo's work. It was Viviani who first related that Galileo discovered the principle of the pendulum after observing a lamp swinging in the Pisan cathedral and that he disproved Aristotle's law of fall experimentally by throwing weights from the top of the Leaning Tower of Pisa.<sup>2</sup>

As Galilean studies developed, however, historians became more and more aware that Viviani may have presented a distorted picture of Galileo. At the end of the last century Antonio Favaro (1847-1922), the editor of the National Edition, claimed that Viviani had changed Galileo's date of birth from 15 February to 19 February 1564, and that he had done so to bring it closer to Michelangelo's death, which occurred on 18 February of the same year. At the beginning of the present century Emil Wohlwill (1835-1912) pointed out that there is no evidence to support certain other details in Viviani's biography, including the stories about

\* Institut für Geschichte der Naturwissenschaften der Universität München, Museuminsel 1, D-8000 Munich 26, Federal Republic of Germany.

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<sup>1</sup> Vincenzo Viviani, "Racconto istorico della vita del Sig. Galileo Galilei . . ." in *Fasti consolari dell'Accademia Fiorentina*, ed. Salvino Salvini (Florence, 1717), pp. 397-431, also in *Le opere di Galileo Galilei* (Edizione nazionale), ed. Antonio Favaro, 20 vols. (Florence: G. Barbèra, 1890-1909; rpt. 1929-1939, 1964-1966, 1968) (hereafter *Galileo, Opere*), pp. 597-646; and Niccolò Gherardini, "Vita del Signor Galileo Galilei . . ." in Giovanni Targioni Tozzetti, *Notizie degli aggrandimenti delle scienze fisiche accaduti in Toscana nel corso di anni LX del secolo XVII*, 3 vols. (Florence, 1780) (Bologna: Forni, 1967), Vol. II, pp. 62-76, also in *Galileo, Opere*, Vol. XIX, pp. 633-640.

<sup>2</sup> Galileo, *Opere*, on pp. 603 (the pendulum), 606 (the Leaning Tower).

the lamp in the cathedral of Pisa and the Leaning Tower. Doubt about the latter story was strengthened by Lane Cooper (1875–1959) in *Aristotle, Galileo, and the Tower of Pisa*, where he pointed out that Galileo did not mention this specific experiment in any of his writings.<sup>3</sup>

Despite the many arguments against Viviani's presentation of Galileo, many historians believe that he was a reliable biographer and that Galileo's experimental work contributed much to the development of his thought. Favaro himself argued that, in general, Viviani was a reliable biographer despite the inexactitude in his report of Galileo's date of birth. And Stillman Drake believes, although there is no evidence for it, that Galileo did perform the Leaning Tower experiment.<sup>4</sup>

To what extent can one rely on Viviani? Certainly not everything he said is an invention, and his life of Galileo is still a valid source of information, provided that it is considered in its proper historical context. In Viviani's day ideas about the writing of history and biography differed from ours. At that time history could still be written as a moral lesson, as a forum for philosophical or religious ideas, or even as part of a literary enterprise.<sup>5</sup>

One may argue that Viviani's account of Galileo's life and work has a Baconian flavor. Yet there is no evidence that Viviani knew of Francis Bacon's works, for Bacon does not appear in any of Galileo's writings or in any of the documents—published or unpublished—related to Viviani's biography that are collected in Volume 11 of the Galilean Collection of manuscripts in the National Library in Florence. Indeed, Bacon seems relatively unknown in Italy in general. A list of "works concerning experimental matters" compiled for the Accademia del Cimento in 1656 by one of its members, Carlo Rinaldini, contains works of the most important contemporary philosophers, such as René Descartes and Pierre Gassendi, but not those of Bacon.<sup>6</sup> Who, then, influenced Viviani?

It is, of course, obvious—and has already been pointed out by several historians, including Favaro and Wohlwill—that Viviani was following the Renais-

<sup>3</sup> Antonio Favaro, "Sul giorno della nascita di Galileo," *Memorie del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 1887, 22:703–711; Emil Wohlwill, "Über einen Grundfehler aller neueren Galileibiographien," *Münchener Medizinische Wochenschrift*, 1903, 50:1850–1851; Wohlwill, "Die Pisaner Fallversuche," *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 1905, 4:229–248; Wohlwill, "Der Abschied von Pisa," *ibid.*, 1906, 5:230–249, 439–464; 1907, 6:231–242; and Lane Cooper, *Aristotle, Galileo, and the Tower of Pisa* (Ithaca, N.Y.: Cornell Univ. Press, 1935) (Port Washington, N.Y.: Kennikat Press, 1972). Favaro argued that Wohlwill's claims were in general exaggerated, though he admitted that Viviani had on some occasions distorted facts; see Favaro, "Sulla veridicità del 'Racconto storico della vita di Galileo' dettato da Vincenzo Viviani," *Archivio Storico Italiano*, 1915, 73(1.2); and Favaro, "Di alcune inesattezze nel 'Racconto storico della vita di Galileo' dettato da Vincenzo Viviani," *ibid.*, 1916, 74(2.3–4).

<sup>4</sup> Antonio Favaro, "Vincenzo Viviani," *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 1912/13, 72(2):1–155, on pp. 100–101, rpt. in Antonio Favaro, *Amici e corrispondenti di Galileo*, ed. Paolo Galluzzi, 3 vols. (Florence: Salimbeni, 1983), Vol. II, pp. 1009–1163, on p. 1108 (for additional details and related bibliography see the appendix below); and Stillman Drake, *Galileo at Work: His Scientific Biography* (Chicago/London: Univ. Chicago Press, 1978), p. 415.

<sup>5</sup> For the importance of rhetoric in early modern biographies of scientists see Paul Lawrence Rose, *The Italian Renaissance of Mathematics: Studies on Humanists and Mathematicians from Petrarch to Galileo* (Geneva: Droz, 1975), Ch. 11; and Nicholas Jardine, *The Birth of History and Philosophy of Science: Kepler's A Defense of Tycho against Ursus, with Essays on Its Provenance and Significance* (Cambridge: Cambridge Univ. Press, 1984), Ch. 8.

<sup>6</sup> See *Le opere dei discepoli di Galileo Galilei: Carteggio*, ed. Paolo Galluzzi and Maurizio Torrini (Florence: Giunti-Barbèra), Vol. I: 1642–1648 (1975), Vol. II: 1649–1656 (1984); Vol. II, pp. 377–383. For a critique of history of science bearing Bacon's stamp see Joseph Agassi, *Towards an Historiography of Science* (The Hague: Mouton, 1963; Middletown, Conn.: Wesleyan Univ. Press, 1967).

sance practice of turning biography into hagiography. Yet no attempt has been made, to the best of my knowledge, to examine Viviani's story from the point of view of contemporary historiography. In particular, I have found no mention of Viviani's adherence to the Vasarian model—an adherence that is directly attested by the fact that Viviani, on one occasion at least, more or less copied from Vasari.<sup>7</sup> The purpose of this article is to present Viviani's life of Galileo in its historical context, within the framework of contemporary practices and the true purposes of its author. Using Volume 11 of the Galilean Collection, which contains many documents on Galileo's life and career, the manuscript drafts of Viviani's "Racconto storico," and other documents on which Viviani relied when he wrote his essay (many of them unpublished), I will try to show that Viviani was conditioned by what he assumed to be his readers' lack of interest in theory and mathematics and by the biographical standards of his day, of which Vasari's *Vite* is the most famous example.

#### VIVIANI

Viviani was a Florentine of noble birth. As a child he was a prodigy in mathematics, and when he was presented at court in 1638, at the age of sixteen, he so impressed Grand Duke Ferdinand II de' Medici (1610–1670) with his mathematical talent that the latter granted him a scholarship and introduced him to Galileo.<sup>8</sup>

Galileo at that time was confined by the Inquisition to his house in Arcetri, near Florence. Although he was seventy-four years old and blind, he was still very active as a scientist; his *Two New Sciences* appeared that year in Leyden, and he was still engaged in many scientific projects. However, he needed assistance and welcomed Viviani as his amanuensis, and in 1639 Viviani moved into his house. As Viviani says, their relations were not confined to scientific collaboration but resembled those of father and son.<sup>9</sup> In 1641 another outstanding young mathematician, Evangelista Torricelli (1608–1647), moved from Rome to join Galileo and Viviani in Arcetri.

<sup>7</sup> On the social, political, and economic background of Tuscan culture in Vasari's and Galileo's day see Giancarlo Garfagnini, ed., *Firenze e la Toscana dei Medici nell'Europa del '500*, 3 vols. (Florence: Olschki, 1983). On the relation between Galileo and the renaissance of the arts see esp. the classic Pierre Duhem, *Etudes sur Léonard de Vinci*, 3 vols. (Paris, 1909–1913) (Paris: F. de Nobele, 1955), esp. Vol. III. Alistair C. Crombie describes Galileo as a Renaissance virtuoso (in the Italian sense of the term), in "Galileo in Renaissance Europe," in *Firenze e la Toscana dei Medici*, ed. Garfagnini, Vol. II, pp. 751–762. Giorgio de Santillana argues that Galileo's real predecessors are exactly those praised by Vasari, in "The Role of Art in the Scientific Renaissance," in *Critical Problems in the History of Science*, ed. Marshall Clagett (Madison: Univ. Wisconsin Press, 1959), pp. 33–65; see also the discussion by Crombie, pp. 66–101. A more recent work is Paolo Rossi, *Philosophy, Technology, and the Arts in the Early Modern Era*, trans. Salvator Attanasio (New York: Harper & Row, 1970). None of these authors, however, says that Viviani was directly inspired by Vasari.

<sup>8</sup> For Viviani's life and career see the documents in Gal. MS 155, some of them published in Angelo Fabroni, *Lettere inedite di uomini illustri . . .*, 2 vols. (Florence, 1773–1775), Vol. 1, pp. 23–24, and *Discepoli: Carteggio* (cit. n. 6), Vol. II p. 96. See also the autobiographical Viviani to Marquis Abbé Salviati, 5 Apr. 1697, in Fabroni, *Lettere*, Vol. 1, pp. 4–22. The most detailed biography of Viviani is Favaro's "Vincenzio Viviani" (cit. n. 4); more recent is Maria Luisa Bonelli, "L'ultimo discepolo: Vincenzo Viviani," in *Saggi su Galileo Galilei*, ed. Carlo Maccagni (Florence: Barbèra, 1972), pp. 656–688. For an outline of Viviani's life and work in relation to his contribution to the Accademia del Cimento see W. E. Knowles Middleton, *The Experimenters: A Study of the Accademia del Cimento* (Baltimore/London: Johns Hopkins Univ. Press, 1971), pp. 36–39.

<sup>9</sup> Fabroni, *Lettere*, Vol. 1, p. 7.

After Galileo's death in 1642, Torricelli was appointed Tuscan Court Mathematician in Galileo's place. Viviani continued to collaborate with him, and together they performed, in 1644, the famous vacuum experiment that bears Torricelli's name. After Torricelli's death in 1647, Viviani had a successful career: he gradually became the successor of Galileo and Torricelli at court, became a member of prestigious Tuscan and foreign academies, and was offered important scientific positions by several European kings. He declined all these offers, choosing to remain in Florence at the disposal of the Tuscan court. He died at the age of eighty-one, having published three or four lengthy mathematical works and a few short ones, and leaving no fewer than 104 volumes of unpublished manuscripts.<sup>10</sup>

Despite his successful intellectual career, Viviani's main interest throughout his life was in keeping Galileo's memory alive. His devotion sometimes appears exaggerated or even obsessive. He collected as many of Galileo's papers and belongings as he could find, made endless inquiries concerning the details of Galileo's life, had a bust of Galileo placed above the entrance to his house and an inscription in Galileo's memory fixed to its wall, and even asked to be buried near him. Above all, he devoted most of his life to collecting Galileo's works. It is within this context that one should consider his life of Galileo.<sup>11</sup>

#### GALILEO'S COLLECTED WORKS

Viviani's life of Galileo, or at least an early draft of it, was intended for inclusion in the earliest collection of Galileo's writings, which a Bolognese editor, Carlo Manolessi, was preparing in the early years of the decade 1650–1660. Although this edition could have included only part of Galileo's writings—publication of the *Dialogue on the Great World Systems* was of course still forbidden—the idea was welcomed by Galileo's followers and by his former patrons, the Medici, who offered Manolessi their assistance and support. Viviani's and Gherardini's essays were written as part of this effort: Viviani reports that the prince had in mind to ask a "very literate" person to write a final version of Galileo's life to be included in the Bologna edition.<sup>12</sup>

Things, however, did not turn out as Galileo's patrons and followers had

<sup>10</sup> Gal. MSS 155–258; contents listed in Favaro, "Vincenzo Viviani" (cit. n. 4), pp. 126–147 (pp. 1134–1155 in the reprint). For a complete list of Viviani's published works see Pietro Riccardi, *Biblioteca matematica italiana . . .*, 2 vols. (Modena, 1870–1880; Milan: Görlich, 1952), Vol. I, pp. 626–630.

<sup>11</sup> Viviani's numerous inquiries concerning Galileo's life are attested by the many documents and letters he collected in Gal. MS 11, catalogued with many helpful references in Angiolo Procissi, *La Collezione Galileiana della Biblioteca Nazionale di Firenze*, 2 vols. (Rome: Istituto Poligrafico dello Stato, 1959–1985), Vol. I, pp. 13–16. For the bust and the inscription see Viviani, *Divinatio in Aristaei . . .* (Florence, 1701), pp. 121–128, and the related diagrams following. Viviani's house, with the bust and inscription, still exists in Via dell'Amore (near S. Maria Novella, now called Via S. Antonino, no. 11).

<sup>12</sup> *Opere di Galileo Galilei . . . in questa nuova edizione insieme raccolte, e di varij trattati dell'istesso autore non più stampati accresciute . . .*, ed. Carlo Manolessi (Bologna, 1655–1656). For correspondence relating to the Bologna edition, mainly between Viviani and Manolessi, see *Discepoli: Carteggio* (cit. n. 6), Vol. II; see also Viviani to Elia Diodati (a friend of Galileo's in Paris), 1656, *ibid.*, pp. 301–308. Galileo's followers helped Manolessi mainly by collecting and sending him Galilean manuscripts, and Prince Leopold was asked to use his good offices to convince the Inquisition to grant permission to publish controversial passages.

hoped. The Bologna edition appeared in 1655–1656 without the planned life of Galileo, probably because Manolesi's work did not satisfy Galileo's followers; Viviani on one occasion complained that Galileo's works deserved a more elegant presentation.<sup>13</sup> The final biography of Galileo may never have been written: if it was, it did not survive.

Viviani's and Gherardini's outlines, however, did survive, and we owe their preservation chiefly to Viviani. Viviani had in mind a grand edition of Galileo's works, in which the Latin works would be translated into Italian and vice versa, and throughout his life he collected an enormous quantity of material related to Galileo, which forms a great part of the Galilean Collection of manuscripts in the National Library of Florence. But he never brought this ambitious project to completion, mainly because he was too much of a perfectionist, never entirely satisfied with the material he had amassed and reluctant to stop collecting and begin publishing. For much the same reason, most of Viviani's own scientific work remained unpublished, and an edition of Galileo's works, as Viviani would have liked to see it, only appeared two centuries after his death, under Favaro's supervision. Favaro, however, could hardly have published his National Edition without the materials collected by Viviani.<sup>14</sup>

Most of the biographical material concerning Galileo is now collected in Galilean MS 11. This volume contains two drafts of Viviani's "Racconto istorico," a copy of Gherardini's life of Galileo with a list of Viviani's annotations, a few undated biographical notes by Galileo's son, Vincenzo Galilei (1604–1649), and many other documents—in part written or annotated by Viviani—such as genealogical data on Galileo's family.<sup>15</sup> In 1659 Viviani wrote a second essay concerning Galileo's work, "Lettera di Vincenzo Viviani al Principe Leopoldo de' Medici intorno all'applicazione del pendolo all'orologio," which gave his version of the details of Galileo's discovery of the principle of the pendulum.<sup>16</sup>

These four early biographical essays, two by Viviani—the "Racconto istorico" and the "Lettera" on the pendulum—one by Gherardini, and a very short one by Vincenzo Galilei, were published by Favaro in Volume XIX of the National Edition. Of the four, only Viviani's "Racconto istorico" and Gherardini's life had been published previously. Viviani's biography was the first to be published and the most important.

<sup>13</sup> *Discepoli: Carteggio*, Vol. II, p. 321.

<sup>14</sup> Viviani presents his project of collecting Galileo's works in *Quinto libro degli elementi d'Euclide* (Florence, 1674), pp. 99–106. It has often been claimed that the work of Galileo's followers was hindered by the Catholic church; see, e.g., A. Natucci, "Vincenzo Viviani," in *Dictionary of Scientific Biography*, ed. Charles C. Gillispie, 16 vols. (New York: Scribners, 1970–1980), Vol. XIV, pp. 48–50. But the role of the church in Italy's scientific decline during this period, though no doubt major, has sometimes been exaggerated. In Viviani's case I found little evidence of interference. As early as 1656 he had at his disposal enough material to publish an outstanding edition of Galileo's works, even within the limitations set by the Inquisition; his papers testify that primarily his own hesitations prevented him from completing the work. For Favaro's reliance on Viviani's documents see Favaro, "Documenti inediti per la storia dei manoscritti Galileiani nella Biblioteca Nazionale di Firenze," *Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche*, 1885, 18:1–112, 151–230.

<sup>15</sup> For the handwritten copy of Gherardini's life of Galileo see Gal. MS 11, fols. 3–19; for Viviani's annotations, fol. 20; for Vincenzo Galilei's notes, fols. 126–129 (all in *Opere*, Vol. XIX, the last on pp. 594–596).

<sup>16</sup> Galileo, *Opere*, Vol. XIX, pp. 647–659. A draft of the "Lettera" is in Gal. MS 85, fols. 39–50 (a second draft is in the National Library of Paris).

Favaro labeled the two drafts of Viviani's "Racconto storico" in Galilean MS 11 *A* and *B*; the earliest (though posthumously) printed version, of 1717, differs slightly from *A* and *B* and is therefore also an important document—Favaro labeled it *S* after its editor, Salvino Salvini. All these versions bear the date 29 April 1654, but *S* is an improved version of *B*, and *B* is an improved version of the earliest draft, *A*, which may have been written for the Manolesi edition (although I cannot prove this conjecture). As the changing handwriting testifies, Viviani wrote *A* and *B* at different periods of his life: *B* is almost certainly the version he was preparing for his own planned edition of Galileo's works.<sup>17</sup>

Publishing all three versions in the National Edition would have been superfluous, since the many differences between them appeared to add nothing to an understanding of Galileo. Favaro was well aware that Viviani was a perfectionist and remarked that the many small variations were part of a continuous and endless process of improving the text. In 1668 Viviani wrote to the mathematician Michelangelo Ricci (1619–1682) in Rome that his life of Galileo was "approaching perfection," but in 1692, at the age of seventy, he was still looking for documents related to Galileo's life: he wrote Domenico Soderini inquiring about the date of Galileo's baptism. Hence Favaro chose to publish only one version, footnoting those variations among the three he considered worth noticing; he published *B*, rather than *A* or *S*, because it was the latest authentic text.<sup>18</sup>

Nearly a century has passed since Favaro's lifetime, and in the meantime the history of science in general and Galilean studies in particular have developed considerably. It may be useful, therefore, to have another look at Viviani's life of Galileo in its various drafts and at other related documents contained in Galilean MS 11, especially those Favaro left unpublished.

#### THE "RACCONTO ISTORICO"

Viviani's "Racconto storico" is a concise, eloquent summary of Galileo's life—it occupies less than forty pages in the National Edition. Even a Galileo expert would find it hard to notice that it contains inexactitudes; not only does it flow smoothly, but it has long been the accepted truth. The "Racconto" goes through the stages of Galileo's life and career: his youth and studies in Florence and Pisa, his professorships in Pisa and Padua, his many controversies, his telescopic discoveries, his return to the Tuscan court, his campaign for Copernicanism, his trial, and, finally, his scientific work in old age, when Viviani collaborated with him. The biography concludes with some general remarks about Galileo's personal traits: he was cheerful, open-minded, practical, generous, easily angered but quick to forgive, and well versed in arts and letters. Viviani also lists some of Galileo's friends and followers.

Throughout Viviani stresses Galileo's practical talents as a scientist, musician, and even painter. He says that Galileo

owned very few books, though the best and of the first class. True, he praised the good things that had been written in philosophy and in geometry to elucidate and awaken the mind to their own order of thinking and maybe higher, *but* he said that the

<sup>17</sup> *A*: Gal. MS 11, fols. 72–118; *B*: Gal. MS 11, fols. 22–68.

<sup>18</sup> Gal. MS 11, fol. 174. For the history of Viviani's life of Galileo see Antonio Favaro, "Vincenzo Viviani e la sua 'Vita di Galileo,'" *Atti R. Ist. Veneto*, 1902/3, 50(2):683–703.

main entrance to the very rich treasure of natural philosophy was *observations and experiments*, which, through the senses as keys, could reach the most noble and inquisitive intellects.<sup>19</sup>

In reporting that the oscillating lamp of the cathedral of Pisa inspired Galileo to construct his own pendulum and verify its nature, Viviani remarks: "By very precise experiments he verified the equality of its vibrations."<sup>20</sup> He goes on to say that after having grasped the principle, Galileo applied it to a series of inventions for measuring time and motion and for medical purposes. But as Favaro points out, the so-called Galilean lamp, still hanging in the cathedral, was put up only in 1587, four years after Galileo is said to have observed its swing.<sup>21</sup> Even were it assumed that another lamp hung there earlier, there remains the problem that Galileo mentions the constancy of the pendulum's swing for the first time only fifteen years after the date Viviani gives for the discovery, and there is no evidence that he knew the principle any earlier or used it to invent an instrument to count pulse rates.<sup>22</sup> On the contrary—as Galileo mentions repeatedly in his *Dialogue*—he and his contemporaries used a normal pulse as the best measure of time.<sup>23</sup> As to the refutation of Aristotle's law of fall, Viviani reports—or invents—the description of Galileo "demonstrating this by *repeated experiments* performed from the height of the bell tower of Pisa in the presence of other lecturers and philosophers and all the student body."<sup>24</sup>

Many other details in Viviani's biography are questionable. He relates, for instance, that Galileo had to leave Pisa in part because he had offended a high-ranking personality by expressing an unfavorable opinion on a project to dredge the port of Leghorn; but there is no trace of such a project in the Tuscan archives. Viviani also reports that among Galileo's students in Padua was no less a personage than King Gustavus II Adolphus of Sweden (1594–1632), although there is no evidence that Gustavus Adolphus ever visited Italy. Wohlwill was the first to express doubts concerning these stories.<sup>25</sup>

Although these details have been questioned, many of them also appear in

<sup>19</sup> Galileo, *Opere*, Vol. XIX, p. 625 (italics added): "Era perciò provvisto di pochissimi libri, ma questi de' migliori e di prima classe: lodava ben sì il vedere quanto in filosofia e geometria era stato scritto di buono, per dilucidare e svegliar la mente a simili e più alte speculazioni; ma ben diceva che le principali porte per introdursi nel ricchissimo erario della natural filosofia erano l'osservazioni e l'esperienze, che, per mezzo delle chiavi de' sensi, da i più nobili e curiosi intelletti si potevano aprire." All translations are my own unless otherwise noted. See also pp. 601, 603, 606, 607, 609, 621 ("perspicacissimo osservatore"), 625 (on Galileo's practical talents); 602, 604 (on his talents as a musician and a painter); 626, 627 (on his general interest in music and in sculpture).

<sup>20</sup> *Ibid.*, p. 603: "E facendone esperienze esattissime, si accertò dell'egualità delle sue vibrazioni."

<sup>21</sup> Favaro, "Sulla veridicità" (cit. n. 3), pp. 16–17. In his "Lettera" of 1659 Viviani says that Galileo observed the pendulum in the Pisan cathedral around 1583; Galileo, *Opere*, Vol. XIX, p. 648.

<sup>22</sup> Galileo mentioned the isochronism of the pendulum for the first time in Galileo to Guidobaldo del Monte, 29 Nov. 1602, *Opere*, Vol. X, pp. 27–100.

<sup>23</sup> Galileo, *Dialogo . . . sopra i due massimi sistemi del mondo . . .* (Florence, 1632), *Opere*, Vol. VII, pp. 46, 54, 180; trans. Stillman Drake in *Dialogue concerning the Two Chief World Systems: Ptolemaic and Copernican* (Berkeley/Los Angeles: Univ. California Press, 1953; 1962), pp. 22, 30, 154. Drake has claimed that Galileo and his contemporaries used musical *tempi* to compare intervals of time; this may have been true of Galileo, but not all scientists had his musical training; see Stillman Drake, "The Role of Music in Galileo's Experiments," *Scientific American*, 1975, 232(6):98–104.

<sup>24</sup> Galileo, *Opere*, Vol. XIX, p. 606 (italics added): "Dimostrando ciò con replicate esperienze, fatte dall'altezza del Campanile di Pisa con l'intervento delli altri lettori e filosofi e di tutta la scolaresca."

<sup>25</sup> *Ibid.*, pp. 606 (on the port of Leghorn), 629 (on Gustavus Adolphus); and the three Wohlwill references in n. 3.



Gherardini's report. That essay is even shorter than Viviani's—about a third the length—and he admits frankly that his memory may have betrayed him and hence that he may not be a very reliable biographer. He describes Galileo's life only until his return, in 1610, to Florence from Padua; like Viviani, he concludes with remarks about Galileo's character and interests. Gherardini's literary style is not as polished as Viviani's, although the deletions in his drafts testify that he made an effort to improve it. Like Viviani, he says that Galileo had very few books and that "his studies depended on continuous observation while making deductions from all things he saw, heard or touched, the subject[s] of his philosophy. He used to say that the book from which one ought to learn is the book of nature which is open to everybody."<sup>26</sup>

Gherardini repeats the story of Galileo's objections to the port of Leghorn project, adding that the high-ranking personality in question was Giovanni de' Medici (1567–1621), the illegitimate son of Grand Duke Cosimo I (1519–1574). (Viviani may diplomatically have avoided naming Giovanni de' Medici because he was in the Medicis' service.) Gherardini also says that Gustavus Adolphus was one of Galileo's students in Padua.<sup>27</sup> However, he does not mention observations of a pendulum in the Pisan cathedral or experiments from the Leaning Tower. Viviani's notes to Gherardini's life indicate that Gherardini had written his biography independently.

#### VIVIANI'S AUDIENCE

Viviani's and Gherardini's essays share another characteristic: numerous stylistic corrections and improvements. As one might expect from a perfectionist, and from a Florentine working in a period when Italian (i.e., Tuscan) was increasingly used by learned people, Viviani writes in a polished style. Yet his drafts, especially draft *B*, contain so many stylistic corrections as to suggest that he may have been aiming his work at a specific audience that would require particularly polished language. Gherardini's manuscripts also contain many stylistic improvements. He was probably writing for the same audience, and although he may not have been as learned as Viviani, the style of his final product is clear, if not as polished, as Viviani's.

Although Viviani does not say explicitly for whom he was writing, we know that he intended his life of Galileo to be included in his proposed collections of Galileo's works. Draft *A* is formally addressed as a letter to Prince Leopold, but Viviani of course had a larger audience in mind. The later draft, *B*, has two different beginnings (both published by Favaro): the first is the same as the beginning of *A*: the second is a somewhat rhetorical introduction turning the "letter" into a general essay. The fact that Viviani planned to have Galileo's Latin works translated into Italian, and vice versa, and the style of his biographical sketch indicate that his intended audience was broader than "professional scientists." Scientists writing exclusively for other scientists, including Viviani's contemporaries Bonaventura Cavalieri (1598–1647), Gian Alfonso Borelli (1608–1679), and Torricelli, almost always wrote in Latin and paid no particular atten-

<sup>26</sup> Galileo, *Opere*, Vol. XIX, p. 646: "Lo studio suo dependea dalla continua osservazione, con dedurre da tutte le cose che vedea, udiva o toccava, argomento di filosofare; e diceva egli ch' il libro nel quale si dovea studiare era quello della natura, che sta aperto per tutti."

<sup>27</sup> *Ibid.*, pp. 638 (on Giovanni de' Medici), 642 (on Gustavus Adolphus).

tion to style—and, although a poor literary style does not necessarily preclude clarity, historians of science have often been frustrated by the obscurity of these three scientists.<sup>28</sup> Viviani, on the other hand—like Giordano Bruno and Galileo—wrote in Italian for the general educated public.<sup>29</sup>

The educated public in Italy in those days consisted mainly of the educated nobility and the learned clergy. In Tuscany in Viviani's day it came primarily from the nobility, as Furio Diaz says in his recent history of the Medici grand duchy, and nobles associated with the court predominated. This public used to meet in the various literary academies, such as the Florentine Academy and the Accademia della Crusca, in which Viviani was active. Later he also became a member of the Accademia Arcadia, the prominent literary academy founded in Rome in 1690, with branches all over Italy, which was devoted to preserving the purity of the Italian language against the "curly" Baroque influences. Viviani's emphasis on style and his association with these groups suggests that he was writing for just such an educated audience.<sup>30</sup>

The academies were for Viviani, as they had occasionally been for Galileo, the best avenue to a broad intellectual public. First, Viviani had free access to these institutions, whereas it might have been difficult for him to establish direct contact with more conservative learned institutions like the University of Pisa—the most important and prestigious cultural institution in Tuscany—or the intellectual religious orders such as the Jesuits or the Dominicans. Second, the academies had a broad and heterogeneous public, ranging, in addition to the educated nobility, from rich merchants with artistic and literary tastes to academics—clerics and laymen—whose interests went beyond their specific field.

Literary materials circulated in seventeenth-century Italy in several ways. Printed works, often in the form of letters, were of course the main avenue; occasionally manuscript copies of essays, letters, or essays in the form of letters were circulated. One of the most famous examples was Galileo's "Letter to Benedetto Castelli" (1613), a copy (or a partial copy) of which reached Francis Bacon in England through intermediaries.<sup>31</sup> A common way to address members

<sup>28</sup> Maximilien Marie, in his *Histoire des sciences mathématique et physique*, 12 vols. (Paris, 1883–1888; New York/Nendeln: Kraus Reprint: 1977), Vol. IV, p. 90, proposes giving Cavalieri the prize for obscurity. Alexandre Koyré says that Borelli wrote atrociously, discouraging the best-willed reader: Koyré, "La mécanique de J. A. Borelli," *Revue d'Histoire des Sciences*, 1952, 5:101–138, on p. 101.

<sup>29</sup> A pioneering work on "scientific" language from the Middle Ages to Galileo's day is Leonardo Olschki, *Geschichte der neusprachlichen wissenschaftlichen Literatur*, 3 vols. (1919–1927) (Vaduz: Kraus Reprint, 1965); one chapter trans. as "Galileo's Literary Formation," in *Galileo, Man of Science*, ed. Ernan McMullin (New York/London: Basic Books, 1967), pp. 140–159. See more recently Maria Luisa Altieri Biagi, *Galileo e la terminologia tecnico-scientifica* (Florence: Olschki, 1965).

<sup>30</sup> See Furio Diaz, *Il granducato di Toscana: I Medici* (Turin: UTET, 1976), pp. 422–463, esp. pp. 424–427. On books, libraries, and readers in Galileo's day see also Leandro Perini, "Libri e lettori nella Toscana del Cinquecento," in *Firenze e la Toscana dei Medici*, ed. Garfagnini (cit. n. 7), Vol. I, pp. 109–131. On the academies in Galileo's time, mainly the Florentine Academy, see Eric Cochrane, "Le accademie," *ibid.*, pp. 3–17. On the transformation of the literary enterprise and on the reading public in sixteenth-century Tuscany see Cochrane, "The Florentine Background of Galileo's Work," in *Galileo, Man of Science*, ed. McMullin (cit. n. 29), pp. 118–139; and Umberto Pirotti, "Aristotelian Philosophy and the Popularization of Learning: Benedetto Varchi and Renaissance Aristotelianism," in *The Late Italian Renaissance, 1525–1630*, ed. Cochrane (London: Macmillan, 1970), pp. 168–208.

<sup>31</sup> Galileo, "Lettera a Benedetto Castelli," in *Opere*, Vol. V, pp. 279–288. There are many copies of this letter, listed by Favaro in his "Avvertimento," *ibid.*, p. 267. The copy to Bacon was sent by Toby Matthews; see *ibid.*, Vol. XII, p. 255.

of the literary academies in particular was to present lectures at their meetings; eventually the academy would publish these lectures. A typical example is Torricelli's *Lezioni accademiche*, the lectures he delivered at the Accademia della Crusca between July 1642 and September 1643; these were published posthumously in 1715.<sup>32</sup> Sometimes essays dealing with controversial topics were published under a pseudonym, as was the description of Torricelli's vacuum experiment, published in 1663 by his friend Carlo Dati (1619–1679) under the pseudonym Timauro Antiata and entitled "Lettera a Filaleti."<sup>33</sup> Dati was a Florentine intellectual and an officer of the Accademia della Crusca; "Filaleti"—from the Greek for "lovers of the truth"—was a name commonly used as a pseudonym, but there was also at that time an Accademia dei Filaleti in Venice.

There is no evidence that Viviani circulated his life of Galileo or that he lectured on it to a literary academy. Favaro remarks that he guarded his essay with great care, not even sending a copy to Manolessi, and saved it for his own collection of Galileo's writings. But finally—when Viviani failed to carry out his own project—the "Racconto istorico" was published by none other than the Florentine Academy, which confirms that the essay was written for this type of public.<sup>34</sup>

The members of these literary academies had their own particular expectations as far as science was concerned and were not very fond of mathematics. In 1642, when Torricelli was admitted to the Accademia della Crusca, Cavalieri wrote him a letter of congratulation that also gave advice on speaking to the members of this illustrious academy. He first describes their expectations:

I hear that they expect physical rather than mathematical things, and perhaps they are right, for the former resemble more the chaff [*crusca*], whereas the latter is the flour—the true food and nutriment of the intellect. It is advisable to meet their expectations, and more than that, the *universal* expectation, that has little esteem for mathematics, unless it sees some applications.

Cavalieri scornfully advises Torricelli how to deal with this type of intellectual:

It is therefore advisable to have ready two types of argument to satisfy them all. And more than that, to satisfy the public, which decides the value of doctors and doctrines by the number of their followers, one has to avail oneself of what is more easily sold, so as to serve the public better and deceive it, or better, to kill the intellect, because the public wants to be treated this way.<sup>35</sup>

<sup>32</sup> *Lezioni accademiche d'Evangelista Torricelli* (Florence, 1715); rpt. in *Opere di Evangelista Torricelli*, ed. Gino Loria and Guiseppe Vassura, Vols. I–III (Faenza: Montanari, 1919), Vol. IV (Faenza: Lega, 1944), Vol. II, pp. 1–99.

<sup>33</sup> *Ibid.*, Vol. I, p. 2, pp. 441–482.

<sup>34</sup> Favaro, "Vincenzio Viviani" (cit. n. 4), p. 100 (p. 1108 in the reprint). Salvini's book (cit. n. 1), in which Viviani's "Racconto istorico" was published, is a collection of essays on the lives and works of the consuls of the Florentine Academy, including Galileo, who was elected consul in 1619 (he was never active) and resigned in 1622.

<sup>35</sup> *Discepoli: Carteggio* (cit. n. 6), Vol. I, p. 18 (italics added): "Sento che vogliono cose piuttosto fisiche che matematiche, e forse con ragione, poichè quelle assomiglierei io piuttosto alla crusca, e queste al fior di farina, vero cibo e nutrimento dell'intelletto. Nondimeno conviene accomodarsi al loro genio, anzi al genio universale, che non istima punto le matematiche se non ne vede qualche applicazione. . . . Onde conviene esser fornito di due sorti di roba per soddisfare a tutti i gusti. Anzi per soddisfare al pubblico, che argomenta il valore de' dottori e delle dottrine dal numero de' seguaci, bisogna provvedersi di quella che è più di spaccio e per servirlo bene ingannarlo, o direi assassinare gl'ingegni, poichè il pubblico vuole esser trattato così per esser servito bene."

Torricelli followed Cavalieri's advise: his *Lezioni accademiche* are devoid of mathematics and full of rhetoric; they present graphically the practical aspects of physics. They are also very different from Torricelli's other writings, which are almost entirely devoted to geometry and, except for a few passages, written in Latin and with much less rhetoric.

Cavalieri's letter throws considerable light on the audience for which Viviani was writing. Viviani may well have heard Torricelli's lectures and even have read the letter, as it was part of the material that Torricelli left him. In any case, the "Racconto storico" fits Cavalieri's prescription: like Torricelli's *Lezioni accademiche*, it emphasizes the empirical and the practical applications of physics. Viviani presumably did not imagine that one day his readers would be skeptical historians of science. Those historians have overlooked Cavalieri's letter in this context; although it was published sixty years ago, I have not seen it related to Viviani's life of Galileo. Favaro and Wohlwill, for example, never mention the preference of such scientific writers as Cavalieri.<sup>36</sup>

Viviani was almost certainly writing to fulfill the expectations of a specific audience, one that wanted to hear about the practical applications of science rather than about mathematics. Viviani adapted his sketch to such expectations by emphasizing the practical, empirical aspects of Galileo's work. Yet these expectations were not the only constraint he had to face. Other textual corrections—the most illuminating for my thesis—indicate that he had to accommodate to additional requirements, namely, the general pattern according to which biographies were written in his day.

#### PATTERNS OF RENAISSANCE BIOGRAPHY

Lives of great figures, including scientists, are often distorted by their followers, so that biographies become hagiographies. This was particularly true during the Renaissance, when history was still influenced by patterns established in classical antiquity and biographies were written according to an established model. Vasari's *Vite* is the classic example. Giorgio Vasari (1511–1575) was a painter and architect in the service of Grand Duke Cosimo I; his collection of biographies of Renaissance artists, published for the first time in 1550 and reissued in 1568 in an enlarged edition, is among his major achievements.<sup>37</sup>

Another important collection of Renaissance biographies, related more directly

<sup>36</sup> Favaro, however, may not have seen Cavalieri's letter before he published Viviani's "Racconto storico" in 1907, since the letter was published only in 1919, with Torricelli's correspondence: Torricelli, *Opere* (cit. n. 32), Vol. III, pp. 72–74. Lanfranco Belloni, in *Opere scelte di Evangelista Torricelli* (Turin: UTET, 1975), pp. 551–552, mentions Cavalieri's letter, though not in relation to Viviani.

Maurice A. Finocchiaro has pointed out to me that, strictly speaking, one should distinguish between empiricism and practical applications, and Cavalieri's advice is perhaps more related to the latter. Yet Viviani and his contemporaries did not pay much attention to this distinction. They thought it important to present science as something "tangible," rather than abstract, and both the empirical and practical aspects of science satisfied this stipulation; in fact, Viviani emphasizes both.

<sup>37</sup> Giorgio Vasari, *Le vite de' più eccellenti architetti, pittori e scultori italiani, da Cimabue insino a' tempi nostri* (Florence, 1550); *Le vite de' più eccellenti pittori, scultori, et architettori . . .* (1568). Many other editions, reprints, and translations followed. I have used the following works: Vasari, *La vita di Michelangelo*, ed. Paola Barocchi (Milan/Naples: Riccardo Ricciardi, 1976); Vasari, *Le vite de' più eccellenti pittori, scultori e architettori nelle redazioni del 1550 e 1568*, ed. Rosanna Bettarini, annotated by Paola Barocchi, 5 vols. of text, 2 vols. of notes (Florence: Sansoni, 1966); and Giorgio Vasari, *Lives of the Artists: A Selection*, trans. George Bull, 2 vols. (London: Penguin Books, 1965, 1971).

to the history of science, is Baldi's *Vite de' matematici*. Bernardino Baldi (1553–1617), of Urbino, had been a pupil of Federico Commandino (1509–1575) and between 1587 and 1595 wrote no fewer than 202 lives of mathematicians and philosophers from antiquity to his own day, of which only 57 have so far been published. Like Vasari, who wrote his *Vite* to honor his teacher Michelangelo, Baldi wrote his *Vite* to honor Commandino. P. L. Rose, who has studied these biographies, says that Baldi may have taken Vasari as a model, although he may have been following other examples, such as the work of Diogenes Laertius, the biographer of Greek philosophers.<sup>38</sup>

Was Viviani writing in the Vasarian manner? It is certain that Vasari's *Vite* were still considered a model at this time. But biography was also becoming more critical and erudite; the new style is exemplified by the work of two historians of art, Carlo Cesare Malvasia (1616–1693) and Filippo Baldinucci (1626–1696).<sup>39</sup>

Malvasia was a Bolognese historian of art who wrote within the Vasarian scheme, although he criticized Vasari for neglecting non-Tuscan artists, in particular those from Bologna.<sup>40</sup> I have found no evidence of any direct relation between Malvasia and Viviani, but Malvasia, too, was active in various academies, and, as the modern historian Martino Capucci points out, he was writing for an audience of "academics, men of letters and patriots"—an audience very like Viviani's.<sup>41</sup> In *Le pitture di Bologna*, written three years after Viviani composed his "Racconto storico" and published in 1686, Malvasia praises empirical work with expressions reminiscent of Viviani's. Thus, speaking of his own work, Malvasia says: "It would suffice for me to guide you where you might be persuaded only through *simple eye inspection*. The evidence of the fact should be the one that permits you to judge; as, by means of *experience*, [it is done] in remote England as well as in nearby Florence."<sup>42</sup> Malvasia's audience in Bologna must have had the same expectations as Viviani's in Florence.

<sup>38</sup> For Baldi's *Vite de' matematici* and its history and context see Rose, *Italian Renaissance of Mathematics* (cit. n. 5), pp. 253–279; see also P. L. Rose in "Copernicus and Urbino: Remarks on Bernardino Baldi's *Vita di Niccolò Copernico* (1588)," *Isis*, 1974, 65:387–389. Selections were published in Moritz Steinschneider, "Vite di matematici arabi, tratte da un'opera inedita di Bernardino Baldi," *Bull. Bibl. Stor. Sci. Mat. Fis.*, 1872, 5:427–534; and in Enrico Narducci, "Vite inedite di matematici italiani scritte da Bernardino Baldi," *ibid.*, 1886, 19:335–406, 437–489, 521–640.

<sup>39</sup> For the development of historiography during the Renaissance and in Viviani's day see, e.g., Eric Cochrane, *Historians and Historiography in the Italian Renaissance* (Chicago/London: Univ. Chicago Press, 1981), esp. Ch. 14, on biography. For Vasari's influence see, for the seventeenth century, Martino Capucci, "Dalla biografia alla storia: Note sulla formazione della storiografia artistica nel Seicento," *Studi Secenteschi*, 1968, 9:81–125; Capucci, "Forme di biografia nel Vasari," in *Il Vasari storiografo e artista: Atti del congresso internazionale nel IV centenario della morte* (Florence: Istituto Nazionale di Studi sul Rinascimento, 1976), pp. 299–320; and Ferruccio Ulivi, "L'eredità del Vasari in Italia," *ibid.*, pp. 525–532; and, for the eighteenth century, Gabriele Bickendorf, "Luigi Lanzi's 'Storia pittorica della Italia' und das Entstehen der historisch-kritischen Kuntsgeschichtsschreibung," *Jahrbuch des Zentralinstituts für Kunstgeschichte*, 1986, 2:231–272.

<sup>40</sup> Carlo Cesare Malvasia, *Le pitture di Bologna* (Bologna, 1686) (Bologna: Alfa, 1969), pp. 1–2. Malvasia also falsified evidence; see Marcella Brascaglia's introduction to the reprint of Malvasia's *Felsina pittrice: Vite dei pittori bolognesi* (Bologna, 1678) (Bologna: Alfa, 1971), p. 15.

<sup>41</sup> Capucci, "Dalla biografia alla storia" (cit. n. 39), p. 108. Malvasia does not appear in the list of Viviani's correspondents published by Favaro in "Vincenzio Viviani" (cit. n. 4), pp. 148–155 (pp. 1156–1163 of the reprint).

<sup>42</sup> Malvasia, *Le pitture di Bologna* (cit. n. 40), p. 3 (italics added): "A me basterà il solo guidarvi ove possiate rendervene capace colla semplice oculare ispezione. L'evidenza di fatto esser deve sol quella, che ne costituisca oggi voi giudice; & assomiglianza all'odierna sperienze della non meno

Whereas there may have been no direct relation between Viviani's and Malvasia's works, there certainly is evidence of direct contacts between Viviani and Baldinucci. Baldinucci had much in common with both Vasari and Viviani. Like them, he was in the service of the Tuscan court and even shared Viviani's patron—Prince Leopold de' Medici—for whom he collected artistic works (we owe to Baldinucci an important part of the Uffizi collection); like Vasari, Baldinucci wrote a collection of lives of artists; finally, like Viviani, Baldinucci was a member of the Accademia della Crusca. As an art historian and biographer he was considerably influenced by Vasari, though more thorough and precise—he was the first art historian to make full use of documents—and he corrected many of Vasari's erroneous statements.<sup>43</sup>

It is within this style of writing—inspired by Vasari but more scholarly and better documented—that one should consider Viviani. Indeed the recto of folio 168 in Galilean MS 11 (Figure 1) contains an excerpt from Vasari, in Viviani's own hand, related to Michelangelo's death, and its verso (Figure 2, top) contains a note from Viviani to none other than Baldinucci, inquiring about Michelangelo's death. The answer, farther down on the same page and possibly written by Baldinucci, relies on Vasari.<sup>44</sup> (I will refer later to the exact use Viviani may have

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tanto rimota Inghilterra, che della prossima a noi Firenze." I am indebted to Gabriele Bickendorf for pointing out this significant passage.

<sup>43</sup> Filippo Baldinucci, *Notizie dei professori del disegno da Cimabue in qua . . .*, 6 vols. (Florence, 1681–1728) (Florence, 1845–1847; rpt. in 8 vols., Studio per Edizioni Scelte, 1974–1975). On Baldinucci and Prince Leopold see Paola Barocchi, "Il collezionismo del Cardinale Leopoldo e la storiografia di Baldinucci," in *Omaggio a Leopoldo de' Medici*, ed. Anna Forlani Tempesti and Anna Maria Petrioli Tofani (Florence: Olschki, 1976), pp. 14–25.

<sup>44</sup> The quotation on fol. 168r comes from Vasari, *La vita di Michelangelo*, ed. Barocchi (cit. n. 37), Vol. I, p. 116 (p. 774 of the 1568 edition.) It reads as follows:

Il Vasari nel libro della Vita di Michelangelo stampato da Giunti in Firenze nel 1568 in 4<sup>o</sup> a faccia 774 così, dopo lunghi racconti, scrisse di lui "con conoscimento grandissimo fece testamento di tre parole che lasciava l'anima sua nelle mani di Dio, il suo corpo alla terra; e la roba a' parenti più prossimi imponendo a' suoi che nel passar di questa vita gli ricordassino il patire di Gesù Cristo. E così a 17 di febbraio l'anno 1563, a ore 23 a uso fiorentino, che al Romano sarebbe 1564 spirò per irsene a miglior vita."

This may be translated as follows:

Vasari, in the book of Michelangelo's life, printed in 1568 in Florence by Giunti in quarto, after long tales wrote of him on page 774: "With perfect consciousness he made his will in three sentences, leaving his soul to God, his body to the earth, and his material possessions to his nearest relations, asking his friends that as he died they should recall to him the sufferings of Jesus Christ. And so on 17 February, in the year 1563, at the twenty-third hour according to Florentine reckoning, which by the Roman is 1564, he breathed his last and went to a better life."

I have relied heavily on Vasari, *Lives*, trans. Bull (cit n. 37), Vol. I, p. 417. The quotation on 168v relies on the same paragraph in Vasari. It reads as follows:

Vincenzio Viviani riverisce il Sig. Filippo Baldinucci e supplica a favorirlo qui sotto della notizia dell'anno, mese, giorno, ora, e luogo della morte del divino Michelangelo Buonarroti. / Ricordo cavato dal Vasari / Il divino Michelangelo Buonarroti nella città di Roma ammalatosi, d'una lenta febbre alli 17 di febbraio dell'anno 1563 alle 23, ore, all' uso fiorentino passò da questa all'altra vita. / all'uso romano l'anno 1564. / Il natalizio di questo grand'uomo fu dell'anno 1474 il giorno 6 di marzo in domenica alle 8 di notte al fiorentino.

This may be translated as follows:

Vincenzio Viviani pays his respects to Filippo Baldinucci and begs him to write down here the year, month, day, hour, and place of the death of the divine Michelangelo Buonarroti. / Recollection taken from Vasari / The divine Michelangelo Buonarroti in the city of Rome fell ill with a slow fever [and] on the 17th of February 1563 at the twenty-third hour passed from this to the other life. / According to the Roman reckoning, the year 1564. / The birth of this great man was in the year 1474, on Monday 6th of March at 8 at night in the Florentine [style].

made of these excerpts.) Incidentally, Carlo Manolessi, the editor for whom Viviani initially prepared his life of Galileo, published an edition of Vasari's *Vite* in 1647; like Vasari's classic status, this fact may have induced Viviani to rely on him. As we shall see, Viviani's life of Galileo has much in common with Vasari's *Vite*, but Viviani, like Baldinucci, was more careful about documentation.

The classical Renaissance notions of biography of artists, including Vasari's, Malvasia's, and Baldinucci's, are described in a study carried out fifty years ago by two Viennese scholars, Ernst Kris (1900–1957) and Otto Kurz (1908–1975). Kris and Kurz considered a large number of Renaissance biographies of artists from Giotto to Rembrandt and found that they contained a number of leitmotifs rooted in Greek mythology and aiming at the heroization of the artist.<sup>45</sup>

One recurrent element is an alleged link between the artist and some other great man. Giotto, for example, was presented by Dante in the *Divine Comedy* and by later biographers, mainly during the fifteenth century, as the personal pupil of Cimabue.<sup>46</sup> Although Giotto was certainly influenced by Cimabue, it is not at all certain that the two painters ever met. The noble or heroic figure of the great man often acts as a substitute for the real father of the artist—here Cimabue for the simple peasant who was Giotto's father. The artist's importance is increased in other, similar ways. In more than one case his native genius is said to have a divine origin. Sometimes particular attention is given to the artist's birth, as if the son of a god were being born. Vasari's statement of Michelangelo's hour of birth, with its precise astrological constellation, is derived, according to Kris and Kurz, from this sort of thinking.

Artists are often presented as child prodigies: their relative youth at the time of important accomplishments is stressed. A recurring element often linked to this precociousness is the coincidence by which the future artist finds his vocation. Giotto—initially a simple shepherd—was said to have met Cimabue by pure chance when he was apprenticed to a wood dealer and had run away from the workshop in order to paint. The story was amplified by Lorenzo Ghiberti, and Vasari followed him in relating that Giotto, while working as a shepherd, was drawing a sheep on a smooth piece of rock; Cimabue happened to pass by, recognized his talent, and trained him to be an artist. Vasari himself is known to have invented many anecdotes, including that of Giotto's famous ability to draw a perfect circle.

As these two anecdotes show, the artist is believed to possess a knowledge of nature more profound than the layman's. He is capable, like a magician, of envisaging the whole from a single part: when shown, for example, a lion's claw, he is able to figure out how large the lion is. Biographies of great artists are full of anecdotes illustrating their superiority in this respect.

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Vasari also reported, mistakenly, that Michelangelo was born on 17 February; see Vasari, *La vita di Michelangelo*, Vol. IV, pp. 1834–1835. As Gal. MS 11, fols. 168v, 171, and Viviani's *Divinatio in Aristaei* (cit. n. 11), p. 127, testify, Viviani knew that Vasari was mistaken.

<sup>45</sup> Ernst Kris and Otto Kurz, *Legend, Myth, and Magic in the Image of the Artist*, trans. Alastair Laing, trans. rev. by Lottie M. Newman (New Haven, Conn./London: Yale Univ. Press, 1979); based on Kris and Kurz, *Die Legende vom Künstler: Ein historischer Versuch* (Vienna: Krystall Verlag, 1934), with additions to the original text by Otto Kurz. Ernst Kris's interest in psychoanalysis and contacts with Sigmund Freud certainly contributed to this research. (Freud himself wrote an essay on Leonardo but examined only his sexuality.)

<sup>46</sup> In Dante's *Purgatorio*: see Vasari, *Vite*, ed. Bettarini & Barocchi (cit. n. 37), Vol. II of the annotations, pp. 348–350.

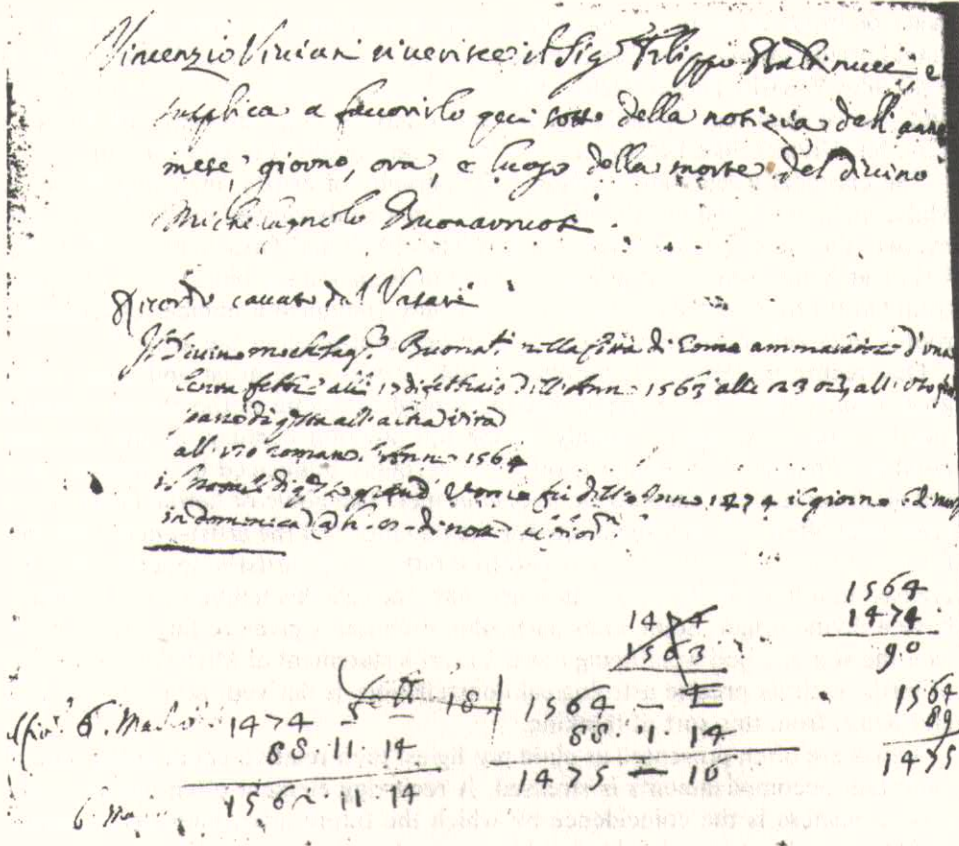


Figure 2. Galilean MS 11, folio 168v. Top: Viviani's note to Baldinucci. Center: A quotation from Vasari. Bottom: Viviani's calculations concerning Michelangelo's life (see also Figure 5 and note 44). Courtesy of the Biblioteca Nazionale Centrale, Florence.

Although Kris and Kurz limited themselves to biographies of artists, their conclusions apply equally well to biographies of scientists of the same period; Viviani's life of Galileo, at least, is a striking confirmation of their findings.

MICHELANGELO'S DEATH AND GALILEO'S BIRTH

Not the least of the ways in which Viviani's life of Galileo follows the classical pattern discerned by Kris and Kurz is in the linking of the date of his birth to that of death of a great man, in this case that hero of the Renaissance, Michelangelo. Alas, Galileo was most likely not born exactly on Michelangelo's date of death (18 February 1564), but on 15 February, the date accepted by the *Dictionary of Scientific Biography*. This date is attested by at least five different horoscopes of Galileo; horoscopes can be taken as reliable evidence for birth dates at least.<sup>47</sup>

<sup>47</sup> See Stillman Drake, "Galileo Galilei," in *Dictionary of Scientific Biography* (cit. n. 14), Vol. V, pp. 237-250, on p. 237. For the horoscopes see n. 50 below. Viviani also reports the existence of links between Galileo and other leading painters of his age: "Cigoli" (Lodovico Cardi), "Bronzino" (Cristofano Allori), "Passignano" (Domenico Cresti), and "Empoli" (Jacopo Chimenti): Galileo, *Opere*, Vol. XIX, p. 602.



made of these excerpts.) Incidentally, Carlo Manolessi, the editor for whom Viviani initially prepared his life of Galileo, published an edition of Vasari's *Vite* in 1647; like Vasari's classic status, this fact may have induced Viviani to rely on him. As we shall see, Viviani's life of Galileo has much in common with Vasari's *Vite*, but Viviani, like Baldinucci, was more careful about documentation.

The classical Renaissance notions of biography of artists, including Vasari's, Malvasia's, and Baldinucci's, are described in a study carried out fifty years ago by two Viennese scholars, Ernst Kris (1900–1957) and Otto Kurz (1908–1975). Kris and Kurz considered a large number of Renaissance biographies of artists from Giotto to Rembrandt and found that they contained a number of leitmotifs rooted in Greek mythology and aiming at the heroization of the artist.<sup>45</sup>

One recurrent element is an alleged link between the artist and some other great man. Giotto, for example, was presented by Dante in the *Divine Comedy* and by later biographers, mainly during the fifteenth century, as the personal pupil of Cimabue.<sup>46</sup> Although Giotto was certainly influenced by Cimabue, it is not at all certain that the two painters ever met. The noble or heroic figure of the great man often acts as a substitute for the real father of the artist—here Cimabue for the simple peasant who was Giotto's father. The artist's importance is increased in other, similar ways. In more than one case his native genius is said to have a divine origin. Sometimes particular attention is given to the artist's birth, as if the son of a god were being born. Vasari's statement of Michelangelo's hour of birth, with its precise astrological constellation, is derived, according to Kris and Kurz, from this sort of thinking.

Artists are often presented as child prodigies: their relative youth at the time of important accomplishments is stressed. A recurring element often linked to this precociousness is the coincidence by which the future artist finds his vocation. Giotto—initially a simple shepherd—was said to have met Cimabue by pure chance when he was apprenticed to a wood dealer and had run away from the workshop in order to paint. The story was amplified by Lorenzo Ghiberti, and Vasari followed him in relating that Giotto, while working as a shepherd, was drawing a sheep on a smooth piece of rock; Cimabue happened to pass by, recognized his talent, and trained him to be an artist. Vasari himself is known to have invented many anecdotes, including that of Giotto's famous ability to draw a perfect circle.

As these two anecdotes show, the artist is believed to possess a knowledge of nature more profound than the layman's. He is capable, like a magician, of envisaging the whole from a single part: when shown, for example, a lion's claw, he is able to figure out how large the lion is. Biographies of great artists are full of anecdotes illustrating their superiority in this respect.

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Vasari also reported, mistakenly, that Michelangelo was born on 17 February; see Vasari, *La vita di Michelangelo*, Vol. IV, pp. 1834–1835. As Gal. MS 11, fols. 168v, 171, and Viviani's *Divinatio in Aristaei* (cit. n. 11), p. 127, testify, Viviani knew that Vasari was mistaken.

<sup>45</sup> Ernst Kris and Otto Kurz, *Legend, Myth, and Magic in the Image of the Artist*, trans. Alastair Laing, trans. rev. by Lottie M. Newman (New Haven, Conn./London: Yale Univ. Press, 1979); based on Kris and Kurz, *Die Legende vom Künstler: Ein historischer Versuch* (Vienna: Krystall Verlag, 1934), with additions to the original text by Otto Kurz. Ernst Kris's interest in psychoanalysis and contacts with Sigmund Freud certainly contributed to this research. (Freud himself wrote an essay on Leonardo but examined only his sexuality.)

<sup>46</sup> In Dante's *Purgatorio*: see Vasari, *Vite*, ed. Bettarini & Barocchi (cit. n. 37), Vol. II of the annotations, pp. 348–350.

Salvini corrected to this date when editing Viviani's "Racconto storico" (i.e., in version *S*). Yet Viviani's own version, published in the National Edition (i.e., draft *B*), states that Galileo was born on 19 February, as does draft *A*. One also finds this date in the biographical notes of Galileo's son, Vincenzo Galilei. There have even been historians who claimed that Galileo was born on the exact date of Michelangelo's death: 18 February. One of them was Giovanni Battista Clemente Nelli (1735–1793), a Florentine historian of science who in 1750 bought Galileo's papers from Viviani's heirs and wrote a book on his life and work. Gherardini was perhaps the most cautious of the early biographers: instead of assigning a date he left a series of ellipsis dots.<sup>48</sup>

Viviani may well not have seen all of the documents on which Galileo's birth is recorded. Favaro believes that Viviani's date is incorrect and possibly based on a document that had been tampered with: one of the horoscopes testifying to Galileo's birth on 15 February.<sup>49</sup> Two of these were published in the National Edition; one (Figure 3) apparently records that Galileo was born on 18 February, but, as Favaro points out, a close look shows very clearly that the "8" of "18" was originally a "5" and was changed into an "8." Favaro did not notice, however, that the digit "5" in "1564" (above  *febbraio*) had also been altered, into a "4" (thus 1564 had been turned into 1464). These two corrections cannot be distinguished in the black-and-white copy reproduced in Figure 3, but in the original document one can see very clearly that the brownish color of the corrections is different from the color of the rest of the document. This difference indicates that the correction was done with a different type of ink, which may have faded differently from the original ink. Perhaps the corrections were not noticeable when they were originally made.<sup>50</sup>

Who altered the chart and why? Were both alterations made by the same person? Why change the year of Galileo's birth to 1464? When was this done? The alteration of the day from "15" to "18" was probably done after the seventeenth century, since in Viviani's day the "8" was commonly written differently (see, e.g., Viviani's calculations in the lower part of Figure 2); Viviani is therefore probably not to blame. In fact Viviani is unlikely to have had access to this document, which is not in the Galilean collection. Favaro does not say explicitly that Viviani falsified the document, but accuses him of having deliberately altered his report of Galileo's date of birth in order to make it correspond more closely to that of Michelangelo's death. Favaro's claims are based chiefly on a number of unpublished documents in Galilean MS 11 (fols. 167–171) that contain information related to Michelangelo's death, including the above-mentioned excerpt from Vasari. Some of this information is in Viviani's handwriting, in particular folios 168v and 171, which bear strange calculations (Figures 2 and 4). According to Favaro, Viviani was trying in these calculations to "torture chronology" in order to make the day and even the hour of Michelangelo's death coincide with those of Galileo's birth (see Figure 5).

<sup>48</sup> Giovanni Bat[t]ista Clemente Nelli, *Vita e commercio letterario di Galileo Galilei . . .* (Lausanne, 1793), pp. 21–22; and Gherardini, "Vita," in Galileo, *Opere*, Vol. XIX, p. 635. I also found in Gal. MS 11 a document—fol. 163v—reporting Galileo's birth date as 15 February, but I cannot say when or by whom it was written or whether it is reliable.

<sup>49</sup> Favaro, "Sul giorno" (cit. n. 3), p. 706.

<sup>50</sup> Codex Magliabecchiano 2.105, fol. 58v, published in Galileo, *Opere*, Vol. XIX, pp. 23–24; see esp. the note above the horoscope on p. 24. Of the horoscopes, only one was in Gal. MS. 11: fol. 190, also published *ibid.*, p. 23. For the others see *ibid.*

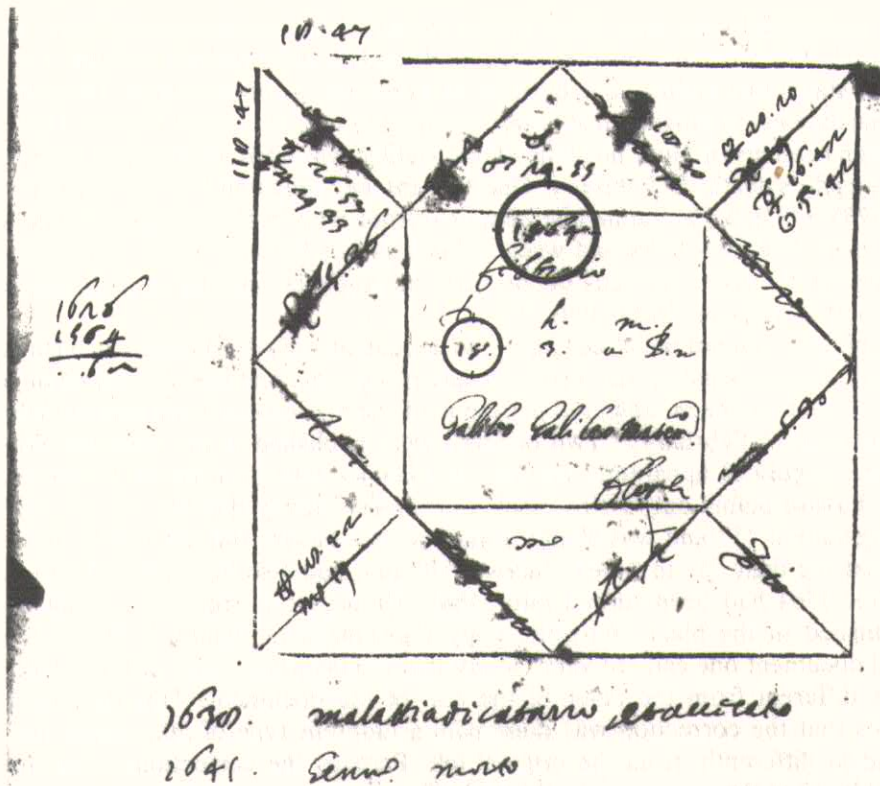


Figure 3. Galileo's altered horoscope: Codex Magliabecchiano 2.105, folio 58v. The circled "18" and "1464" were originally "15" and "1564." Courtesy of the Biblioteca Nazionale Centrale, Florence.

My reading of these calculations, however, does not confirm Favaro's claim. At most, Viviani appears only to have been checking whether the length of Michelangelo's life remained the same in the various dating systems that were in use in his day. During the sixteenth and seventeenth centuries, different Italian cities used different dating systems. In Florence, the city in which Viviani was writing, the years were counted *ab incarnatione*, so that they began on the Feast of the Annunciation (25 March). Pisa, the city in which Galileo was born, used a different system of dating, so that the year began on the *preceding* 25 March. Thus the date of Michelangelo's death would have been recorded in Florence as 18 February 1563, whereas in Rome—the city in which Michelangelo died—and in Pisa the same date would have been recorded as 18 February 1564.<sup>51</sup>

What Viviani's calculations confirm beyond any doubt is that he was following the pattern of classical Renaissance biography in the history of art, exactly as presented by Kris and Kurz: it was important for Viviani to look for some kind of link between Michelangelo and Galileo, and he scrupulously checked the evidence. There is nevertheless no indication that he was trying to distort facts, and

<sup>51</sup> I rely on A. Cappelli, *Cronologia, cronografia e calendario perpetuo* (Milan: Ulrico Hoepli, 1969), p. 11. A related document (Gal. MS 11, fol. 147r) was published by Antonio Favaro in "Scampoli Galileiani XLIV: Il matrimonio dei genitori di Galileo," *Atti e Memorie della Reale Accademia di Scienze e Lettere ed Arti in Padova*, 1891/92, Anno 293, N.S., 8:12–22, on pp. 17–18.

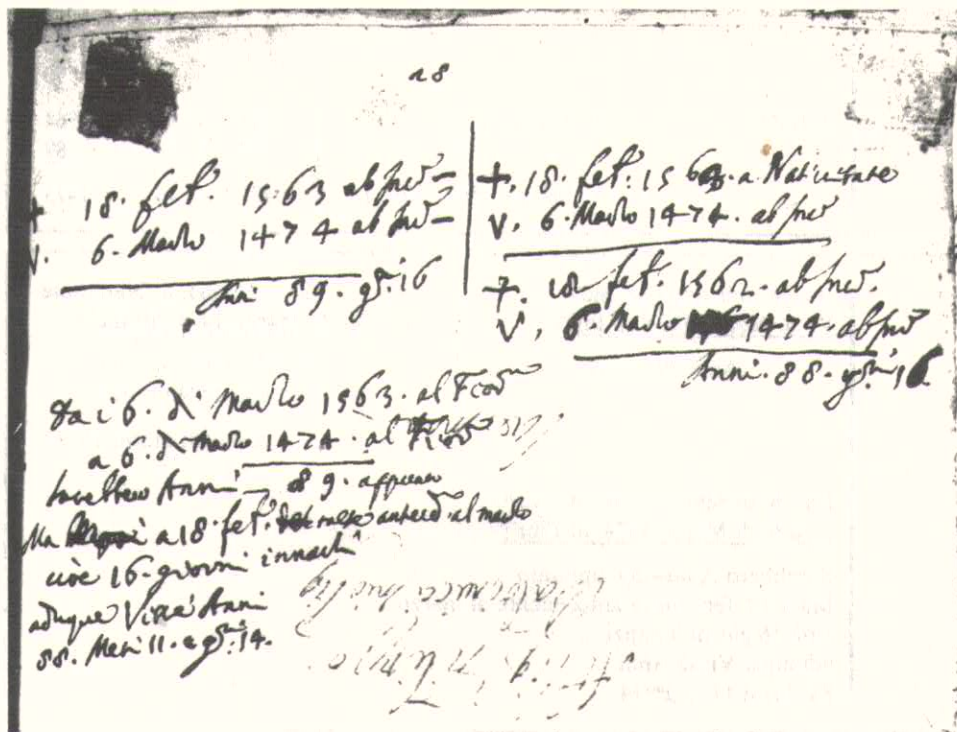


Figure 4. Galilean MS 11, folio 171, with calculations concerning Michelangelo's life (see also Figure 5 and note 44). Courtesy of the Biblioteca Nazionale Centrale, Florence.

in fact the final result of this effort, in both *A* and *B*, was a statement that Galileo was born on 19 February (not 18). It seems to me that Nelli, writing a century later, was more likely than Viviani to falsify the horoscopic chart, since it was he who actually wrote that Galileo was born on 18 February. He too had access to most of the Galilean material, probably including this specific chart. Yet this still does not prove that Nelli is responsible for the forgery.

I was, however, unable to determine how Viviani reached the date 19 February. This choice of date is rather bizarre, since in 1692 Viviani obtained a copy of Galileo's baptismal certificate stating that Galileo was baptized on 19 February.<sup>52</sup> In Viviani's time, as today, it was unlikely that a child would be baptized on the date of birth. Although there is no special prescription as to exactly when baptism should take place, in the seventeenth century it was normal to wait at least three days after the birth, and in winter the sacrament was postponed as long as possible. Galileo himself baptized his daughter Virginia nine days after her birth, although she was born in summer.<sup>53</sup>

Yet Viviani chose 19 February for his "Racconto istorico" and wrote it in both drafts *A* and *B*. He may have relied on Vincenzo Galilei's notes, which he obtained, as he says, as early as 1666. In 1692, when he obtained the copy of

<sup>52</sup> The documents related to Viviani's inquiries are in Gal. MS 11, fols. 182–188; the baptismal certificate is published in Galileo, *Opere*, Vol. XIX, p. 25. See Favaro, "Sul giorno" (cit. n. 3), pp. 708–709.

<sup>53</sup> Virginia Galilei was born on 12 Aug. 1600 and baptized on 21 Aug.: Galileo, *Opere*, Vol. XIX, p. 218.

A	al fio <sup>no</sup>	6 Marzo 1474 — —	1564 — —	1564
		88. 11. 14	88. 11. 14	1474
		6 Marzo 1562. 11. 14	1475 — 16	1475
				90
B	+ . 18. feb. 1563 ab Inc <sup>e</sup> —		+ . 18. feb. 1564. a. Nativitate	
	V. 6. Marzo 1474 ab Inc <sup>e</sup> —		V. 6. Marzo 1474. ab Inc <sup>e</sup>	
	Anni 89. g <sup>ni</sup> 16		Anni 88. giorni 16	
	Da i 6. di Marzo 1563. al Fior <sup>no</sup>		a 6. di Marzo 1474. al Fior <sup>no</sup>	
Sarebbero Anni—89. appunto				
Ma a 18. feb. mese antecedente al marzo				
cioè 16 giorni innanzi				
adunque Visse Anni				
88. Mesi 11. e g <sup>ni</sup> :14				

**Figure 5.** A: Transcription of Galilean MS 11, folio 168v, bottom (see Figure 2); all fio<sup>no</sup> means "in the Florentine style." B: Transcription of Galilean MS 11, folio 171 (see Figure 4). The bottom section reads: "From the 6th March 1563 in the Florentine style / to the 6th March 1474 / in the Florentine style / should be exactly 89 years. / But to 18th February, the month preceding March / namely 16 days earlier / thus he lived 88 years 11 months and 14 days."

Galileo's certificate of baptism, Viviani was already fairly old, and he might not have corrected his essay. If he was relying on Vincenzo, his drafts in Galilean MS 11 must have been written after 1666, and there must have been an earlier draft written in 1654. Or perhaps Viviani tried another linkage—between Galileo and Copernicus, who was born on 19 February 1473.<sup>54</sup> But this is only a speculation, and there is no evidence that Viviani knew Copernicus's date of birth.

The custom of linking great men seems gradually to have gone out of fashion in the eighteenth century; Salvini was most likely concerned with accuracy when he corrected Viviani's report of Galileo's birth date. But throughout his essay Viviani does his best to embellish Galileo's image. This is what Kris and Kurz call the heroization of the artist in biography.

#### THE HEROIZATION OF GALILEO

Viviani presents Galileo as a child prodigy: "in his early age Galileo showed the liveliness of his talent by building, in his free time, alone, instruments and small machines." The expressions Viviani uses to describe Galileo's precocious talent

<sup>54</sup> I owe this suggestion to Heribert M. Nobis.

are very nearly copied from Vasari's life of Giotto: Vasari says of the young Giotto: "mostrando in tutti gli atti ancora *fanciulleschi* una *vivacità* e *prontezza d'ingegno*"; and Viviani says "ne' prim'anni della sua *fanciullezza* a dar saggio della *vivacità* del suo *ingegno*."<sup>55</sup> Viviani adds that Galileo was self-taught and had read his first important Latin authors when still very young; he learned Greek, played the lute, and was so talented as a painter that he could have become a professional artist. Although all this may have been true, there is no supporting evidence. It conforms so neatly to the general pattern of Renaissance biography that it would not be surprising if Viviani had invented it, or at least stretched the facts.

After recounting Galileo's childhood Viviani describes his university studies. Here the variations in his drafts become interesting: they evidence considerable stretching of the truth, and often reinforce doubts based on other grounds. The age at which Galileo entered university is given variously as eighteen (in *A* and *B*), seventeen (in *B*), and, finally, sixteen (also in *B*). According to the documents in the archives of the Studium of Pisa, Galileo began his studies in 1581, when he was over seventeen and a half.<sup>56</sup> Similarly, the age at which Galileo is said to have started studying mathematics varies. He was introduced to the subject by Ostilio Ricci (1540–1603), who was in the service of the grand duke and who played a role in Galileo's life like Cimabue's alleged role in Giotto's life. Viviani says at first that Galileo started studying with Ricci when he was twenty-two years old (in *A* and *B*); he then reduces the age to nineteen (in *B*).<sup>57</sup> (The patterns of Renaissance biography also appear in Gherardini's account of Ricci. In an anecdote reminiscent of the casual meeting between Giotto and Cimabue, he alleges that Galileo acquired his first mathematical notions by hiding himself outside the room in which Ricci was tutoring the pages of the grand duke.<sup>58</sup>)

Viviani adds other details about Galileo's initiation into mathematics and then improves on them. In manuscript *A* he says that Galileo had learned geometry in *pochi mesi* (a few months); in *B* the word *mesi* (months) is deleted in pencil, and *tempo* (time) is substituted. Viviani clearly intended to write "a short time," which is vague and may sound even shorter than "a few months," but forgot to alter the declension of *pochi* to *poco*, leaving the grammatically incorrect *pochi tempo*.<sup>59</sup>

One additional possible instance of this kind of stretching of the truth may in fact be a response to new information. In manuscript *A* Viviani says that at the age of twenty-four Galileo had already formulated the appendix to his *Two New Sciences*, dealing with centers of gravity of solid bodies; in *B* the age is given as twenty-one. Galileo did write this treatise in his youth, but it is not known exactly when. He mentioned it in a letter to his friend Elia Diodati. The original

<sup>55</sup> Galileo, *Opere*, Vol. XIX, p. 601: "Cominciò questi ne' prim'anni della sua fanciullezza a dar saggio della vivacità del suo ingegno, poichè nell'ore di spasso esercitavasi per lo più in fabbricarsi di propria mano varii strumenti e machinette"; cf. Vasari, *Vite*, ed. Bettarini and Barocchi (cit. n. 37), Vol. II, p. 96 (p. 139 in the 1568 edition). Bull translates thus: "Giotto showed in all his boyish ways such unusually quick intelligence and liveliness": Vasari, *Lives of the Artists* (cit. n. 37), Vol. I, p. 157.

<sup>56</sup> *A*: Gal. MS 11, fol. 77; *B*: Gal. MS 11, fol. 28; cf. Galileo, *Opere*, Vol. XIX, p. 602. For the Studium archives see *ibid.*, p. 32.

<sup>57</sup> *A*: Gal. MS 11, fol. 80; *B*: Gal. MS 11, fol. 31; cf. Galileo, *Opere*, Vol. XIX, p. 604.

<sup>58</sup> Galileo, *Opere*, Vol. XIX, pp. 636–637.

<sup>59</sup> *A*: Gal. MS 11, fol. 81; *B*: Gal. MS 11, fol. 32; cf. Galileo, *Opere*, Vol. XIX, p. 605.

letter is lost, but the National Library in Florence owns several excerpts; two of these excerpts say that Galileo was twenty-two years old at the time, the others that he was twenty-one.<sup>60</sup> Diodati may have sent the original to Viviani, who copied it or had it copied. In any case, given the biographical model he is following, Viviani does his best to emphasize Galileo's youth along with his very impressive accomplishments.

Viviani also remarks, just as classical biographers of artists do, that Galileo had a particularly deep knowledge of nature: "Nature chose Galileo as the one who should reveal a part of those secrets."<sup>61</sup> His alleged discovery of the principle of the pendulum at the age of nineteen, after observing the swinging of the lamp in the cathedral of Pisa, is a typical anecdote illustrating how a whole principle can be induced from a single particular. The pendulum in Pisa may be considered an instance of the proverbial lion's claw.

Viviani's (and Gherardini's) story concerning the Swedish king, Gustavus Adolphus, also appears to be apocryphal, since there is no evidence that he was ever in Italy; moreover, he was only sixteen years old in 1610, when Galileo left Padua. Yet there is evidence that two Swedish princes, both called Gustavus or Gustav, spent some time in Italy and may even have studied with Galileo; one of them was the son of the deposed King Erik XIV. Here again we have a case of stretching the evidence: the kernel of truth in the story is amplified, with a more important personage substituted for the lesser, and with the connection with Galileo possibly invented.<sup>62</sup>

The most famous and controversial anecdote in Viviani's "Racconto storico" is, of course, the story of the Leaning Tower experiment. The experiment was performed, according to Viviani, when Galileo was a professor in Pisa, between 1589 and 1592—more or less in the period in which he is said to have written his *De motu*. *De motu* is a collection of notes, written in Latin, dealing with motion in a medium; they were published by Favaro in Volume I of the National Edition. Since the dating of these notes is uncertain, it may be risky to relate them to the Leaning Tower experiment. Yet in *De motu* Galileo repeatedly gives the example of a body falling from a tower, although he presents no specific experimental description.<sup>63</sup> Perhaps Galileo did drop things off the tower to test this theory, and it is not unlikely that the story has some truth in it. Moreover, during the seventeenth century it was fashionable for professors in Pisa to perform experiments from the top of the Leaning Tower. Giorgio Coresio, a professor of Greek,

<sup>60</sup> A: Gal. MS 11, fol. 82; B: Gal. MS 11, fol. 33; cf. Galileo, *Opere*, Vol. XIX, p. 605. See also Galileo to Elia Diodati, 6 Dec. 1636, *ibid.*, Vol. XVI, pp. 523–524, excerpted in Gal. MS 76, fols. 85r, 76v (Galileo was twenty-two), 29r, 73r, 147r (twenty-one). The appendix was published in *Opere*, Vol. I, pp. 179–208, among Galileo's early works.

<sup>61</sup> Galileo, *Opere*, Vol. XIX, p. 602: "Dalla natura fu eletto per disvelare al mondo parte di que' segreti."

<sup>62</sup> See Antonio Favaro, "L'episodio di Gustavo Adolfo di Svezia nei racconti della vita di Galileo," *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 1905/6, 65(2):17–39; and Favaro "Ancora, e per l'ultima volta, intorno all'episodio di Gustavo Adolfo di Svezia nei racconti della vita di Galileo," *Att. Mem. R. Accad. Sci. Lett. Padova*, Anno 366, 1906/7, N.S., 23:6–12.

<sup>63</sup> Galileo, *Opere*, Vol. XIX, pp. 251–419; some parts trans. by I. E. Drabkin in *On Motion and on Mechanics* (Madison: Univ. Wisconsin Press, 1960), pp. 3–131; others in *Mechanics in Sixteenth-Century Italy: Selections from Tartaglia, Benedetti, Guido Ubaldo, and Galileo* (Madison/Milwaukee/London: Univ. Wisconsin Press, 1969), pp. 329–387. For falling bodies see *On Motion*, pp. 27, 31n, 38, 87, 101, 107, 127; and *Mechanics*, p. 374. On the dating of *De motu* see Drabkin, "A Note on Galileo's *De motu*," *Isis*, 1960, 51:271–277.

reported having performed a similar experiment in 1612. Vincenzo Renieri (1606–1647), a follower of Galileo and the incumbent of the Pisan chair of mathematics, reported having performed like experiments repeatedly in 1641. And Carlo Rinaldini (1615–1698), a professor of philosophy who collaborated with Viviani, reported having tried, with a Torricellian tube, to measure the difference in air pressure at the top and the bottom of the tower.<sup>64</sup> If Galileo did not actually perform the famous experiment, Viviani needed little imagination to present an anecdote that would be sufficiently realistic while conforming to the scheme of the biography he was writing.

There is an interesting correction in Viviani's drafts relating to the Leaning Tower experiment. In *A*, Viviani ends the story by saying, "All this is treated extensively [*diffusamente*] by him in his *last* Dialogues concerning Two New Sciences." In *B*, one finds a small variation: "All this is treated extensively by him in the *said* Dialogues concerning New Sciences." Finally, the whole remark is canceled.<sup>65</sup> Viviani probably first remembered Aristotle's law of fall as being refuted in the *last* Days of the *Two New Sciences*—dealing with motion.<sup>66</sup> But he then realized the refutation came in the *First Day* of that work—dealing mainly with strength of materials—and wrote "said Dialogues" instead of "last Dialogues." Yet on this occasion Aristotle's law is refuted by means of a *thought* experiment.<sup>67</sup> One should remember that Viviani's readers did not like this sort of nonempirical argument; the Leaning Tower story would have been much more convincing. This might have been why Viviani finally canceled the remark.

This and many other details in Viviani's "Racconto storico" show that he was bound to a certain biographical model. Although Favaro and Wohlwill discussed the truthfulness of some of these details and both (vaguely) admitted that there may have been an element of legend in Viviani's story, neither noticed Viviani's similarity to Vasari. In general, many of the variations in the versions of Viviani's biography are not based on available documents. The only dates among those quoted that we can now document with any precision are those of Galileo's birth and the age at which he entered university: in both cases Viviani is wrong. It seems that Viviani took advantage of occasions in Galileo's life that could not be documented and altered the facts so as to magnify his aptitude and his general empirical scientific image. Although Viviani was certainly writing in the tradition of Vasari, and Vasari did invent facts, Viviani, like Baldinucci, was more thoroughly "scholarly," and his stories at least have a kernel of truth; it would there-

<sup>64</sup> Galileo, *Opere*, Vol. IV, p. 242 (Coresio); *ibid.*, Vol. VIII, pp. 305–306 (Renieri); and *Le opere dei discepoli di Galileo Galilei* (Edizione nazionale), Vol. I: *L'Accademia del Cimento*, Part I, ed. Giorgio Abetti and Pietro Pagnini (Florence: Barbèra, 1942), p. 341 (Rinaldini).

<sup>65</sup> *A*: Gal. MS 11, fol. 83: "Che tutto si vede poi diffusamente trattato da lui nelli ultimi Dialoghi delle due nuove Scienze"; *B*: Gal. MS 11, fol. 34: "Che tutto si vede poi diffusamente trattato da lui nelli sudetti Dialoghi delle nuove Scienze" (italics added in both quotations); cf. Galileo, *Opere*, Vol. XIX, p. 606.

<sup>66</sup> Galileo, *Discorsi e dimostrazioni matematiche, intorno à due nuove scienze attenenti alla meccanica & i movimenti locali . . .*, *Opere*, Vol. VIII, pp. 33–448; on pp. 107–108; trans. by Henry Crew and Alfonso de Salvio as *Dialogues concerning Two New Sciences* (New York: Macmillan, 1914), on pp. 62–63. (Stillman Drake's *Two New Sciences* [Madison: Univ. Wisconsin Press, 1974] was not available to me.)

<sup>67</sup> Here Galileo showed that Aristotle's law leads to a logical contradiction. Assuming that a large stone falls faster than a smaller one, if the two stones are united, then the smaller should slow the greater. But the two united stones form a third bigger stone, which, according to Aristotle, should fall faster than the two single stones. Hence Aristotle's law is self-contradictory.



fore be an error to dismiss them altogether, as Wohlwill and some other historians have suggested doing.

#### CONCLUSION

It has always been evident that Viviani adapted Galileo's image to the literary expectations of his day. But his "Racconto storico" and its drafts have never been studied to find out for exactly what audience and according to what literary model he was writing, or what effect the perfectionism testified by his collection of all the relevant papers had on his essay. We now see that Viviani was writing for a specific audience—the audience that used to meet in literary academies, was interested above all in the practical application of science, and was not particularly fond of pure mathematics. Furthermore, Viviani certainly took his cue from Vasari, embellishing Galileo's image by means of analogous anecdotes, although his perfectionism and also perhaps the new, more scholarly trends in writing biography may have induced him to preserve a kernel of truth in those anecdotes.

These conclusions regarding Viviani's biographical style could perhaps be generalized to include the many other scientific biographies of his time, but these must first be studied, just as Kris and Kurz studied artists' biographies. Such a study would address the question whether one can speak of a seventeenth-century "scientific biography" that differs essentially from the standard Renaissance biography of an artist. Or was "history of science" in Viviani's day in Italy still part of that history of art that Giorgio Vasari had inaugurated a hundred years earlier? Certainly for the sixteenth century, P. L. Rose, pointing out that to "expect Baldi's work to read like a modern history of mathematics would be to commit a serious anachronism," has shown how similar biography in science was to biography in art (although Rose too relies on Viviani when speaking of Galileo).<sup>68</sup> Viviani's life of Galileo indicates that in his day geniuses of science and art were regarded as much the same. This observation is confirmed by Gherardini's biography and by at least one other seventeenth-century biography. In 1683 the German painter and historian of art Joachim von Sandrart (1606–1688) included Galileo and Athanasius Kircher (1601–1680) in his history of art. Moreover, as recent studies show, Von Sandrart was more influenced by Vasari than he admitted in his writings.<sup>69</sup> The archetype of Galileo's most important biography was written before Galileo was even born.

#### EPILOGUE: GALILEO'S IMAGE AS AN EMPIRICIST

My purpose in this article was solely to present the literary context of Viviani's life of Galileo. Yet one can hardly avoid the much-debated question of the extent to which Galileo's work was empirical and the exact role of experiment in his physical investigations. Historians of science, as we have seen, have differing

<sup>68</sup> Rose, *Italian Renaissance of Mathematics* (cit. n. 5), on p. 255. Rose quotes Viviani on pp. 280 (in the chapter on Galileo), 214.

<sup>69</sup> Joachim von Sandrart, *Academia nobilissima artis pictoriae* (Nuremberg, 1683), p. 387. I am indebted to Carlo Maccagni for this observation. Vasari's influence on von Sandrart is discussed by Roberto Salvini in "L'eredità del Vasari storiografo in Germania: Joachim von Sandrart," in *Il Vasari storiografo e artista* (cit. n. 39), pp. 759–771.

answers.<sup>70</sup> The traditional image, stemming from Viviani, features Galileo as a scientist whose work was essentially empirical—further, as the man who inspired and grounded experimental science. This image may initially have been presented to satisfy a certain audience, but it was certainly amplified in the wake of Baconian and positivistic philosophies. Alexander von Humboldt (1769–1859), for instance, even reported that Galileo used a pendulum to measure the height of the Pisan cathedral.<sup>71</sup>

Yet from the end of the last century some historians have argued that Galileo's revolution was essentially intellectual and nonempirical. The first to question Viviani's portrait of Galileo was Emil Wohlwill, who pointed out that there is no evidence to support many details in it. Wohlwill's doubts were sustained by Lane Cooper; Cooper was a philologist rather than a historian of science, and philologists may have a greater sensitivity to legend than historians of science. In the wake of Wohlwill and Cooper, Alexandre Koyré opened a new era in Galilean studies in 1939 by contradicting the accepted view of Galileo as an empiricist; rather, he conjectured that experiment in general did not play any essential role in Galileo's work and even suggested that Galileo had never performed some of the experiments he describes in detail.<sup>72</sup>

Koyré frankly presented his conclusion as an outcome not so much of his remarkable study of the Galilean heritage as of his view of the role of experiment in modern science. He firmly believed that one of the main features of modern science is that it is created a priori. Thus experimental work is nothing more than the embodiment of a preconceived theory, and so the role of experiment in Galileo's work was relatively unimportant. To support his claims Koyré pointed out that there are very few descriptions of experiments in Galileo's writings and that those there are are often too perfect to be true. Thus Koyré also doubted many experiments described by Galileo himself (and not by Viviani), such as the famous inclined plane experiment.

Despite all these arguments against Viviani's picture of Galileo, there are still many historians of science who believe that Galileo's empirical activity contributed much to the development of his thought. Thomas Settle and James MacLachlan, for instance, repeated some of the experiments he described, using, as far as possible, the tools and procedures available to him; despite Koyré's doubts concerning the truthfulness of these experiments, they obtained results similar to those Galileo reported. Furthermore, Drake's recent work with Galileo's notes on motion certainly confirms that Galileo was an *experimenter*, although one can still not say to what extent he was also an *experimentalist*, that is, one who—as Viviani says—regarded experiment as the basis for scientific discovery.<sup>73</sup>

<sup>70</sup> For a detailed survey see Michael Segre, "The Role of Experiment in Galileo's Physics," *Archive for History of Exact Sciences*, 1980, 23:227–252. In that article I discuss the different types of experiment in Galileo's writings, basing my work on James MacLachlan, "A Test of an 'Imaginary' Experiment of Galileo," *Isis*, 1973, 64:374–379 (regrettably without citation).

<sup>71</sup> Alexander von Humboldt, *Cosmos: Essai d'une description physique du monde*, trans. H. Faye, 4 vols. (Paris, 1846), Vol. I, p. 189 (I could not find it in the original).

<sup>72</sup> Alexandre Koyré, *Etudes galiléennes* (Paris: Hermann, 1939, 1966); trans. by John Mepham as *Galileo Studies* (Hassocks, Sussex: Harvester Press, 1978). See also Koyré, "An Experiment in Measurement," *Proceedings of the American Philosophical Society*, 1953, 97:222–237.

<sup>73</sup> Thomas B. Settle, "An Experiment in the History of Science," *Science*, 1961, 133:19–23; MacLachlan, "Test of an 'Imaginary' Experiment" (cit. n. 70); and Stillman Drake, *Galileo Notes on Motion* (Supplemento agli *Annali dell'Istituto e Museo di Storia della Scienza*, Monografia 3), 1979,

Drake also believes, despite the lack of evidence, that Viviani must have heard the story of Galileo's Leaning Tower demonstration from Galileo's own lips in 1641, when he was Galileo's amanuensis. It was then that Vincenzo Renieri wrote to Galileo, and Drake conjectures that Viviani had read Renieri's letters to Galileo and written down the reply. On this occasion, according to Drake, Galileo recalled for Viviani the incident that had occurred some fifty years earlier; had Galileo's letter to Renieri been preserved, it would have provided definite evidence that Galileo's Leaning Tower experiment did take place. But this letter is lost, and Drake's argument relies on "Viviani's accuracy."<sup>74</sup>

How accurate was Viviani and how far does his accuracy justify the view that Galileo was an empiricist? My reading of Viviani's essay shows that he was very accurate in his work and tried to document his facts as well as he could. Viviani was a more "modern" historian than one might think: as the many deletions and variations in the places where he may have distorted facts testify, altering reality must have been very difficult for him; Viviani was too much of a perfectionist—in our sense of the word—to be comfortable composing fiction. This aspect of his character and work may encourage modern historians to give a certain credit to some of his anecdotes and understand them better even if they are not documented, always bearing in mind that Viviani's emphasis on Galileo's empiricism may well have been invited by his audience. Thus Galileo's work *might* have been less empirical than Viviani presented it (as Koyré believes), although Viviani's anecdotes, such as the story of the Leaning Tower, *might* after all have been true, or at least partially true (as Drake believes).

Thus, considering Viviani's "Racconto storico" in its historical context seems to justify all views, and although I do not intend in this short epilogue to solve the problem of Galileo's empiricism, my study of Viviani's biographical sketch does suggest that the whole discussion is perhaps based on the wrong question. Instead of asking, Which of the experiments described by Viviani, or by Galileo himself, did Galileo perform? one should perhaps ask, Why did Viviani (and Galileo) think it important to report these experiments? The answer to this question might shift the discussion to a more historical and less philosophical level.

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Fasc. 2. Settle repeated Galileo's famous inclined plane experiment, MacLachlan a procedure for mixing wine and water, both described in Galileo's *Two New Sciences*.

<sup>74</sup> Drake, *Galileo at Work* (cit. n. 4), pp. 413–415; quoting from p. 415.