Everything in its right place: Francesco Maurolico and the classification of the sciences

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Abstract
European Renaissance was characterized by an unprecedented growth of information determined by discoveries of ancient texts and distant places, technological advancements, and a new attitude towards human culture and history. This growth urged scholars to reconsider the traditional schemas used to organize knowledge, and in doing so they were more often than not put at odds with a past that they were trying simultaneously to recover and challenge. The case of Francesco Maurolico is a prime example of the tension between tradition and innovation that marked Renaissance thinking: fully committed to the recovery of ancient mathematical knowledge and acutely aware of his own original contributions to the discipline, throughout his career Maurolico sought to hammer out a model of classification that could accommodate new mathematical content in a largely traditional structure. By analyzing Maurolico's failed attempts at devising a satisfactory model, the essay aims to show how, during the Renaissance, mathematical research impacted culture at large, thus decisively contributing to the shaping of modernity.

Keywords
Maurolico, Renaissance mathematics, Classification of sciences

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I. Introduction

The European Renaissance, a period defined by the intellectual recovery of classical culture, simultaneously inaugurated a new epoch of cognitive strain. Driven by the dissemination of recovered Greek and Arabic texts, rapid technological advancements, and the unprecedented geographical expansion of the known world, the century witnessed an explosive proliferation of information. This intellectual deluge placed immense pressure on existing structures used to organize knowledge, fundamentally challenging the long-standing encyclopedic ambitions inherited from antiquity.[1]

For centuries, the organization of theoretical philosophy remained anchored by an increasingly eclectic Aristotelian scholasticism, which persisted as the dominant framework in university settings. Aristotle's *Categories* provided the hierarchical model, rigorously separating knowledge domains based on their subject matter and/or epistemological status, with mathematics occupying a middle ground. Within this tradition, mathematics was often partitioned into the discrete (arithmetic) and the continuous (geometry) and grouped into the *Quadrivium*.[2] However, with the flourishing of mathematical practice, scholars across the 16th century increasingly advocated for the mathematization of natural philosophy, and this methodological shift gave rise to *media scientiae*: disciplines like optics, mechanics, and astronomy that defied easy classification by combining the certainty of mathematical demonstration with the mutable reality of sensible, physical matter,

1 See Ann M. Blair, *Too Much to Know: Managing Scholarly Information Before the Modern Age* (New Haven [Conn.]: Yale University Press, 2010); Ann M. Blair, "Revisiting Renaissance Encyclopaedism," in *Encyclopaedism from Antiquity to the Renaissance*, ed. by Jason König and Greg Woolf (Cambridge: Cambridge University Press, 2013), 379–397; Daniel Andersson, "Philosophy and the Renaissance Encyclopaedia," in *Encyclopaedism from Antiquity to the Renaissance*, ed. by Jason König and Greg Woolf (Cambridge: Cambridge University Press, 2013), 398–413; Christel Meier, "Introduction," in *Die Enzyklopädie im Wandel vom Hochmittelalter bis zur Frühen Neuzeit*, ed. by Christel Meier (München: Fink [Münstersche Mittelalter-Schriften 78], 2002), 1–22; Ead., "Transformationen des Enzyklopädischen Wissensbegriffs," in *Die Enzyklopädie im Wandel vom Hochmittelalter bis zur Frühen Neuzeit*, ed. by Christel Meier (München: Fink [Münstersche Mittelalter-Schriften 78], 2002), 23–44; Matteo Valleriani, "From the Quadrivium to Modern Science," *HoST – Journal of History of Science and Technology* 16, no. 1 (2022): 121–132.

2 Charles B. Schmitt, *Aristotle and the Renaissance* (Cambridge, MA: Harvard University Press, 1983), 89–109; Edward Grant, *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts* (Cambridge: Cambridge University Press, 1996), 33–69; Winston Black, "The Quadrivium and Natural Sciences," in *The Oxford History of Classical Reception in English Literature: Volume 1: 800–1558*, ed. by Rita Copeland (Oxford: Oxford University Press, 2016), 77–94; Jens Høyrup, "Mathematics Education in the European Middle Ages," in *Handbook on the History of Mathematics Education*, ed. by Alexander Karp and Gert Schubring (New York: Springer, 2014), 109–124.

and proceeded not only by transforming exisiting mathematical tools but also creating new mathematical objects.[3]

The career of the Sicilian mathematician Francesco Maurolico (1494–1575) stands as a prime illustration of this profound epistemological crisis. Educated in the Humanist tradition, Maurolico dedicated his life to the ambitious reconstruction and correction of the Greek mathematical canon, most notably the foundational works of Archimedes, Euclid, and Theodosius. Simultaneously, his own original treatises introduced revolutionary content, such as the first known formal use of mathematical induction in arithmetic and the application of rigorous Archimedean statics to mechanics, effectively establishing a new geometric standard for natural philosophy. These innovations fundamentally blurred the Aristotelian distinction between discrete and continuous quantities, challenging the very metaphysical boundaries that structured the traditional Quadrivium.

This essay will analyze Maurolico's explicit attempts to organize his work, particularly through the presentation of multiple, inconsistent classification schemes in the preface to his 1575 *Opuscula Mathematica*. Maurolico's inability to settle upon a definitive, coherent model suggests that the content of 16th-century mathematical research had structurally surpassed the capacity of the traditional philosophical container. By examining Maurolico's failed ambition to devise a satisfactory classification, this analysis aims to illuminate how the burgeoning practice of mathematical science decisively impacted the broader culture of knowledge organization, thereby contributing to the intellectual conditions necessary for the shaping of modernity.

II. Maurolico, Archimedes, and the architectural ambition

Maurolico stands among the most intellectually ambitious figures of the Italian Renaissance. Educated within the late Humanist tradition, he devoted his career to restoring and expanding the Greek mathematical canon. The extensive editorial projects he undertook concerning the corpus of Greek mathematics were intended not merely as philological

[3] Sophie Roux, "Forms of Mathematization (14th–17th Centuries)," *Early Science and Medicine* 15, no. 4 (2010): 319–337, 327. See also Pier Daniele Napolitani, "La géométrisation des qualités physiques: les modèles de la théorie des proportions," in *Between Mechanics and Architecture*, ed. by P. Radelet de Grave and E. Benvenuto (Basel–Boston–Berlin: Birkhäuser, 1995), 69–88; Maarten van Dyck, "Applying Mathematics to Nature," in *The Cambridge History of Philosophy of the Scientific Revolution*, ed. by David Marshall Miller and Dana Jalobeanu (Cambridge: Cambridge University Press, 2022), 254–273; Peter Damerow and Jürgen Renn, "The Transformation of Ancient Mechanics into a Mechanistic World View," in *Transformationen antiker Wissenschaften*, ed. by Georg Toepfer and Hartmut Böhme (Berlin; New York: De Gruyter, 2010), 243–268; Maurizio Crosilla, ed., *Guidobaldo del Monte (1545–1607): Mechanica, Statica, and the Emergence of Mathematical Physics* (Berlin: De Gruyter, 2015).

recoveries but as systematic reconstructions of mathematical knowledge according to rigorous demonstrative standards. His method, often designated *ex traditione Maurolyci*, involved providing new interpretations and integrating original classical materials with contributions accrued throughout the centuries.[4]

Since the beginning of his career, Maurolico cultivated a clear encyclopedic ambition: he not only pursued original mathematical research and the recovery of classical texts, but also envisaged a comprehensive, ordered architecture of his own intellectual output. As early as 1528, in the preface to his *Grammaticorum rudimentorum libelli sex*, he included a form of what would become his first *Index Lucubrationum* - a catalogue listing both his published and intended works. This catalogue signals that, from this early stage, he perceived his production as a systematic project rather than a series of isolated treatises.[5] Over the decades, he repeatedly revised and expanded this index: a version appears in the 1543 *Cosmographia*,[6] another in the 1558 *Sphaerica* edition,[7] and still longer ones in the 1568 and 1570 manuscript listings prior to the published *Opuscula Mathematica* of 1575.[8] These successive versions functioned not simply as bibliographical appendices but as strategic maps of his intellectual programme, showing planned works, compendia, and teaching-texts. Crucially, the *Index Lucubrationum* itself became a site of philosophical reflection; its hierarchical arrangement testified to the persistent struggle to impose an ordered structure upon the increasing diversity of mathematical disciplines. The structure of the index reflects the desired intellectual architecture: it records both editions of classical works and his own original treatises, placing them into a sequential scheme that was meant to embed his mathematical productions within the structure of a grand encyclopedia of sciences.

Maurolico's commitment to mathematics was not merely technical; it was a philosophical statement, articulated most clearly in his August 1556 letter to Juan de Vega, Viceroy

4 On Maurolico's life and work, see Rosario Moscheo, *Francesco Maurolico tra Rinascimento e scienza galileiana: materiali e ricerche* (Messina: Società Storia Patria Messina, 1988); Rosario Moscheo, "Francesco Maurolico," *Dizionario Biografico degli Italiani*, vol. 72 (Rome: Istituto della Enciclopedia Italiana, 2009), 404–411.

5 Francesco Maurolico, *Grammaticorum rudimentorum libelli sex Francisco Maurolycio authore* (Messanae in freto Siculo: impressit Petrutius Spira, 1528), 7r–7v.

6 Francesco Maurolico, *Cosmographia* (Venetiis: apud haeredes Lucaeantonii Iuntae, 1543), *epistola dedicatoria*. The work was largely completed by 1535. See Giovanni Ciofarelli's introduction to *Cosmographia* in Maurolico Project, "Electronic Edition of the Mathematical Works of Francesco Maurolico," https://maurolico.it/Maurolico/sezione.html?path=11.A.2 (accessed on 10/11/2025).

7 Francesco Maurolico, *Theodosii Sphaericorum elementorum libri III. Ex traditione Francisci Maurolyci* (Messanae: apud Petrum Spira, 1558), f. *3r.

8 Cfr. Marshall Clagett, "The Works of Francesco Maurolico," *Physis: Rivista internazionale di storia della scienza* 16 (1974): 148–198.

of Sicily.[9] This letter serves as a defense of mathematics against the prevailing humanist contempt for the sciences. Maurolico laments the "calamity of our time" where scholars are more driven by *lucrum* and *ambitio* than by true study, resulting in intellectual chaos; the reading of *circulatorum ineptias,* and the practice of *barbaras voces et pueriles cavillationes* in dialectics.[10] Against this decay in the liberal arts, Maurolico champions mathematics claiming that, *hac demonstrativa facultas*, "it secures the highest citadel in demonstrative worth, concludes without any controversy, and if it is neglected, nothing certain remains."[11] For Maurolico, mathematical proof is the foundation of all secure knowledge, providing the absolute certainty that was lacking in the verbose and contentious fields of rhetoric and scholastic dialectics. Moreover, he explicitly positions his work as a direct corrective to contemporary innovation for its own sake. He rejects the practice of those *qui luxui vitiisque... dediti, bonas artes parvifaciunt*,[12] and stresses his own humility, stating he would not dare to introduce some new things just for the sake of novelties, which most people do today Instead, his priority is ensuring that *veterum authorum volumina quam correctissima potuissem haberem* before adding his own, carefully vetted *emendationes*.[13] In this context, Maurolico defines mathematics by its primary subject: quantity (*quantitas* or *magnitudo*), divided into discrete (*arithmetica*) and continuous (*geometria*). He then immediately expands this definition beyond the traditional scope of number and abstract figure. He notes that the principles of continuous quantity extend to *tempus, locus, motus*, and crucially, to *pondus, momentum ac vis*. These new mathematical species are the sub-

9 The letter, perhaps written as a dedication for the 1558 edition of the *Sphaerica*, is contained in manuscript *Par. Lat. 7473* (cc. 1r–16v). The letter has been printed several times, most recently in Rosario Moscheo, *I Gesuiti e le matematiche nel secolo XVI: Maurolico, Clavio e l'esperienza siciliana* (Messina: Società Messinese di Storia Patria, 1998), 287–306.

10 Bibliothèque Nationale de France, Ms. Lat. 7473, f.1r. "Et deploranda simul nostri temporis calamitas, quando rarissimi sunt literarum cultores, atque ita omnia inversa, ut iam vix ulterius tolerandum sit, pro priscis praestantissimisque authoribus humanitatis, circulatorum ineptias legi, inter dialecticos barbaras voces et pueriles cavillationes frequentari, a caeteris quoque scientiarum professoribus, dum ad lucrum potius aut ambitionem quam ad laudabilem studii finem accelerant, illotis omnia manibus contrectari."

11 BNF, Ms. Lat. 7473, f. 2r. "Nam, vel ex hoc prae caeteris est magnifacienda, quod primam in demonstrandi dignitate sortitur arcem, et citra omnem controversiam concludit, eaque neglecta nil certi superest."

12 BNF, Ms. Lat. 7473, f. 1r.

13 BNF, Ms. Lat. 7473, f. 1v. "Propterea, in studiis meis hoc praecipue curavi, ut veterum authorum volumina quam correctissima potuissem haberem, deinde, si quid in his a tralatoribus bene traditum aut additum fuisset, id non omitterem. Demum, si quid ego quod ad correctionem aut faciliorem demonstrandi viam faceret excogitassem, id cum venia eruditorum traderem. Quibus peractis, aliquid incude nostra elaboratum, iudicioque consummatorum virorum prius expositum emitterem."

jects of his own works *de momentis aequalibus* and *de mechanicis quaestionibus*.[14]

Most of this was driven by Maurolico's encounter, around ten years before, with the *editio princeps* of Archimedes' collected works. Published in Basel in 1544 by Ioannes Herwagen and edited by Thomas Gechauff, this monumental work shifted the focus from earlier, often incomplete or flawed medieval Latin versions to the authentic, rigorous methods of Greek geometry. For a scholar already engaged in reconstructing the geometrical rigor of the ancients, its appearance provided both methodological inspiration and a new point of comparison against which he could better discriminate between original contributions and recoveries of lost wisdom. Archimedes' corpus appeared to Maurolico as an ideal example of unified scientific architecture. His works linked geometry with physical mechanics through rigorous, deductive proofs. This provided a blueprint for Maurolico's encyclopedic project: the ideal classification scheme must be able to house such a unified structure.[15]

On the other hand, however, engaging with Archimedes made Maurolico became fully aware of how far he had been distancing himself from the ancients' approach. The case of *De momentis aequalibus* offers perhaps the clearest expression of this. Maurolico started working on it in the 1520s as a reconstruction of Archimedes' treatise on equilibrium; however, after consulting the 1544 edition, he realized that many of the methods and proofs he had formulated did not appear in Archimedes at all. They were original contributions, arising from his own geometric insight and reasoning, and he recognized that his

[14] BNF, Ms. Lat. 7473, ff. 3r–3v. "Sunt etiam aliae quaedam continuae magnitudinis species, ut tempus, locus, motus, quae tamen ad spacia dimensionum referri possunt: metimur enim motum per spacium peractum, et tempus per motum. Item locus, cum sit corporis receptaculum, omnino eosdem quantitatis limites cum corpore suscipit. Item corpus ipsum sequuntur tres aliae continui species, videlicet pondus, momentum ac vis. Nam, corpora aequalia interdum sunt diversi ponderis, et aequalia pondera diversae magnitudinis. Item aequalia pondera nonnunquam sunt inaequalium momentorum, et aequalia momenta diversorum ponderum, ut patet in stateris. Vis autem est impetus incussi mallei aut securis, per quam saepe fit aliquid, quod neque per pondus neque momentum fieri potest. Ex quibus patet, corpus, momentum, pondus ac vim esse diversas species magnitudinum, de quibus agitur in libro de momentis aequalibus et in mechanicis quaestionibus. Item tam discreta quam continua quantitas aliis aut aliis applicata rebus aliam atque aliam generat scientiam, quae arithmeticae, ut calculus, rhythmica, musice, aut geometriae subiacet, ut astronomia, geographia, chorographia, perspectiva, de quibus postea latius loquemur; quarum authores et prisci et recentiores multi sunt."

[15] Archimedes, *Archimēdous tou Syrakousiou, Ta mechri nun sōzomena, hapanta = Archimedis Syracusani philosophi ac geometrae excellentissimi opera, quæ quidem extant, omnia, multis iam seculis desiderata...* (Basileae: Ioannes Hervagius excudi fecit, 1544). See Marshall Clagett, *Archimedes in the Middle Ages*, vol. III, part III (Philadelphia: The American Philosophical Society, 1978); Pier Daniele Napolitani, "Archimedes," in *The Cambridge History of Science, Volume 3: Early Modern Science*, ed. by Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), 87–111; Paul Lawrence Rose, *The Italian Renaissance of Mathematics: Studies on Humanists and Mathematicians from Petrarch to Galileo* (Genève: Librairie Droz, 1975), 159–184.

own investigations exceeded what Archimedes had done.[16] This realization reinforced his encyclopedic ambitions while simultaneously making the traditional classification problem more difficult. The inherited Aristotelian scheme created a strict hierarchy: Metaphysics (highest abstraction), Mathematics (abstraction from sensible matter, but not from quantity), and Physics (study of mobile, sensible matter). Maurolico's most advanced work, however, belonged to the *scientiae mediae* that violated this boundary: they applied the certainty of geometric deduction to the physical, mutable world of natural philosophy. Maurolico's challenge, therefore, was to create a classification system that could grant these *scientiae mediae* a high theoretical status without entirely subordinating them to the uncertain domain of physics, whose subject matter was characterized by *propter materiae fluxum*. His attempt to resolve this tension by devising multiple classification schemes became the central philosophical struggle of his later career.

Maurolico's scattered but recurrent attention to scientific ordering thus illustrates a key feature of Renaissance intellectual life: the tension between the proliferation of knowledge and the need for conceptual containment. As Ann Blair notes, even though "only a few late Renaissance figures openly rejected received classificatory schemes and the curricula to which they were related," there was a widespread acute sense that the surfeit of knowledge, whether driven by the discovery of things unknown to the ancients, the recovery of classical texts, or the proliferation of printed books, required at least a rethinking of the relationships between disciplines.[17] From this perspective, even where Maurolico's formal schemes were ultimately inconsistent or abandoned, they testify to the epistemic

[16] On the genesis of Maurolico's *De momentis aequalibus* see Pier Daniele Napolitani's introduction to Francesco Maurolico, *Francisci Maurolyci Archimedea. Tomus B. De momentis aequalibus*, ed. by Riccardo Bellé, Pier Daniele Napolitani, and Beatrice Sisana (Pisa: Fabrizio Serra Editore, 2022).

[17] Ann M. Blair, "Organizations of knowledge," in *The Cambridge Companion to Renaissance Philosophy*, ed. by James Hankins (Cambridge: Cambridge University Press, 2007), 291. See also Blair, *Too Much to Know*, 239–245; and, in relation to astronomy, Robert S. Westman, *The Copernican Question: Prognostication, Skepticism and Celestial Order* (Berkeley: University of California Press, 2011), 34–43. The sense of cognitive overload generated by the expansion of the book trade and the recovery of ancient texts is already visible in Petrarch's *De remediis utriusque fortunae*, I.43 where he warns that books have led some to knowledge and others to madness. The intellectual precondition for acknowledging that the ancients left knowledge incomplete is articulated by Coluccio Salutati in *De laboribus Herculis*, I.7.11, where he argues that posterity is both entitled and obliged to supplement inherited knowledge. The topos acquires its full historical charge with geographical discovery and the print revolution: Conrad Gesner, in the preface to his *Bibliotheca universalis* (Zurich, 1545), famously described *confusa et noxia illa librorum multitudo*, while his companion *Pandectarum sive Partitionum universalium libri XXI* (Zurich, 1548) represented the most systematic attempt to convert that anxiety into a classificatory remedy. For the historiographical framework, see Donald R. Kelley, ed., *History and the Disciplines: The Reclassification of Knowledge in Early Modern Europe* (Rochester: University of Rochester Press, 1997).

pressure exerted by the expanding domain of mathematical science, and to the centrality of classification as both a practical and philosophical problem.

III. Maurolico's writings on the classification of sciences

Maurolico addressed the problem of scientific classification throughout his career, producing five known texts over a span of approximately forty years. While relatively small in volume, these writings are historiographically significant, as they illuminate both the genealogy of his intellectual activity and the broader context of his encyclopedic ambitions. For Maurolico, the classification of sciences was never an end in itself. Rather, it was a recurring issue he had to deal with in order to situate his research within a wider, structured framework of knowledge. His engagement with this topic reflects a pragmatic concern: he sought schemes capable of integrating his own discoveries and restitutions of classical science into coherent, teachable systems. All of Maurolico's classification texts show the enduring influence of the Lascarian intellectual milieu. Trained under pupils of Constantine Lascaris – his father Antonio and the priests Francesco Faraone and Giacomo Genovese - and deeply influenced by works such as Giorgio Valla's *De expetendis et fugiendis rebus*, Maurolico consistently relied on models transmitted by this network.[18] Even when he introduced subdivisions to accommodate his own findings, he did not fundamentally depart from these inherited frameworks.[19]

The earliest extant treatment of the classification of the sciences appears in a short text appended to the printed edition of the *Grammaticorum rudimentorum libelli sex*, Maurolico's first published work, which was issued in Messina in 1528. The appendix, entitled *Philosophiae divisio*, is an almost verbatim reproduction of Francesco Faraone's scheme

[18] In this connection, Rosario Moscheo observed that the Lascarian 'school' was "not the institution physically established and operating in Messina, but rather the entire network of cultural relations, mutual influences exerted, friendships established and cultivated by Lascaris - including through his teaching – throughout his Italian *peregrinatio*." This cultural universe, which includes not only Lascaris's pupils active in Messina (with whom Maurolico maintained close personal ties) but also those, such as Giorgio Valla, who had met the Byzantine intellectual elsewhere and remained constantly devoted to him, effectively constitutes, according to Moscheo, Maurolico's own cultural milieu. See Rosario Moscheo, "Scienza e cultura a Messina tra '400 e '500: eredità del Lascaris e 'filologia' mauroliciana," *Nuovi Annali della Facoltà di Magistero dell'Università di Messina* 6 (1988): 595–632, 613; and Rosario Moscheo, "Greek heritage and the scientific work of Francesco Maurolico," in *Medieval and Classical Traditions and the Renaissance of Physico-Mathematical Sciences in the 16th Century: Proceedings of the XXth International Congress of History of Science*, ed. by P. Cinti, F. D'Angelo, and C. Vinti (Viterbo: Università degli Studi della Tuscia, 2001), 15–22.

[19] Cfr. Corrado Dollo, *Modelli scientifici e filosofici nella Sicilia spagnola* (Napoli, 1984), 14.

set out in his *Institutiones grammatices* (1500).[20] This framework ultimately derives from Isidore of Seville's adaptation of Boethius's fivefold division, later appropriated by humanists such as Pietro Pomponazzi, Agostino Nifo, and Marsilio Ficino, and was widely disseminated through pedagogical and encyclopedic works, notably Gregor Reisch's *Margarita philosophica* (1503), which Maurolico himself was familiar with.[21] Significantly, Maurolico extends this traditional schema by including, under geometry, the disciplines of optics (*optica*), catoptrics (*catoptrica*), photisms (*photismi*), and the study of transparent media (*diafana*), as well as the theory of isorrhopa (*de aequiponderantibus*) and geography. This extension reflects his effort to subsume his own mathematical investigations within an established philosophical taxonomy and corresponds closely to his earliest scientific writings - the *Photismi de lumine et umbra* and the initial drafts of *De momentis aequalibus* – composed during the same period as the *Philosophiae divisio*.[22]

[20] Maurolico, *Grammaticorum rudimentorum libelli sex*, c. 123v. The events related to the publication of the first edition of Francesco Faraone's *Institutiones grammatices*, a treatise which would enjoy considerable success in the years to come, have been reconstructed by Alessandra Tramontana and well attest to the cultural influence of Constantine Lascaris in Messina during the first decades of the sixteenth century. The *Institutiones*, in fact, would provoke harsh criticism from another pupil of Lascaris active in Sicily, the humanist Lucio Cristoforo Scobar, who in 1520 published the *Carcinomata pharaonis* as part of his work *De rebus praeclaris syracusanis opuscola*. In these writings, he denounced the alleged errors contained in the *Institutiones* and proposed corrections which were partially accepted in subsequent editions of the *Institutiones*. Beyond the strictly scientific terms of the matter, what is important to note is that the controversy was certainly not unknown to Maurolico, who chose to 'present' himself officially to the Messinese intellectual community precisely with a manual of Latin grammar. This is relevant considering that, as Tramontana emphasizes, there was in Messina, "starting from the 1520s–1530s, and not by chance in conjunction with the resurgence of typographical activity, a composite nucleus of intellectuals who met and discussed systematically, and who, intending to utilize the legacy acquired from the season just past, attempted to define renewed cultural directions according to diversified perspectives, capable of making an impact even beyond the Strait [of Messina]." See Alessandra Tramontana, "L'eredità di Costantino Lascaris nella Messina di Francesco Maurolico e la polemica sulle *Institutiones* di Valla," in *Umanesimo e Università in Sicilia (XV-XVII secolo): Saggi in onore di Daria de Rubertis*, a cura di M. A. Russo (Roma: Aracne, 2013), 133–158, 138.

[21] Cfr. Boethius, *De Trinitate*, in *Patrologia Latina*, vol. 64, ed. by J.-P. Migne (Paris: Garnier, 1847), col. 1250C; Isidore of Seville, *Etymologiae*, ed. by W. M. Lindsay, vol. I (Oxford: Clarendon Press, 1911), II. 24.2–3; Gregor Reisch, *Margarita philosophica* (Freiburg im Breisgau: Johannes Schott, 1503), I, I, ch. 1.

[22] On the *Photismi* and, more generally, on Maurolico's works on optics, see Pier Daniele Napolitani's and Ken'ichi Takahashi's introduction to Francesco Maurolico, *Francisci Maurolyci Optica*, ed. by Riccardo Bellé and Ken'ichi Takahashi (Pisa: Fabrizio Serra Editore, 2017); and Riccardo Bellé, "L'edizione a stampa dei *Photismi de lumine et umbra* (1611) e l'*Index lucubrationum*," *Nuncius: Annali di Storia della Scienza* 29, no. 1 (2014): 101–134.

Main Division (*Latin Term*)	Secondary Definition	Tertiary/Component Disciplines	Maurolico's Extensions (Sub-Geometry)
Metaphysics (*Metaphysica*)	Deals with the first cause, first being.	*Theologia* (discourse on God).	N/A
Physics (*Physica*)	Deals with the nature of the heavens, elements, and things made from elements.	N/A	N/A
Ethics (*Aethica*)	Moral law.	*Monastica*, *Oeconomica*, *Politica* (including laws/rights).	N/A
Mathematics (*Mathematica*)	Deals with quantifiable things.	*Arithmetica*, *Musica*, *Astrologia*.	N/A
Geometry (*Geometria*)	Continuous quantities, forms, ratios.	N/A	*Optica*, *Photismi*, *Catoptrica*, *Diaphana*, *Isorrhopa* (Mechanics), *Geographia*.
Logic (*Logica*)	Deals with discourse.	*Grammatica*, *Rhetorica*, *Dialectica*.	N/A

Tab. 1 – The classification of 1528.

The second text is the *Sermo de divisione atrium*, a work preserved in a single autograph manuscript. The small paper codex contains three short discourses dated by Maurolico in June 1554, during his stay in Catania: *De divisione artium*, *De quantitate*, and *De proportione*.[23] Compared with the brief *Philosophiae divisio* appended to the *Grammaticorum libelli* of 1528, the *Sermo de divisione artium* is a markedly longer and more elaborate text, evidently conceived for pedagogical use. It unfolds as a systematic lecture rather than a schematic summary, and reflects Maurolico's mature concern to present a historically informed and philosophically grounded account of the liberal disciplines. The treatise is divided into two broad parts: the first offers a historical survey of earlier classifications of the sciences, largely derived from Giorgio Valla's *De expetendis et fugiendis rebus*;[24] the second develops a

[23] MS. Molfetta (Bari), Biblioteca del Seminario Minore Vescovile 5-7 H 15, ff. 1r–26r. The manuscript was photographed and published by Graziano Bellifemmine in Francesco Maurolico, *Prologi sive sermones quidam de divisione artium, de quantitate, de proportione*, ed. by Graziano Bellifemine (Molfetta [Bari], 1968).

[24] Cfr. Giorgio Valla, *Georgii Vallae Placentini De expetendis et fugiendis rebus opus in quo omnes scientiae & artes. Quas tum veterum tum nostrae aetatis scriptorum monumenta nobis tradiderunt...*

new division which Maurolico explicitly attributes to his teacher, Giacomo Genovese, and which he adapts to his own conception of the mathematical sciences.[25] Whereas Faraone had distinguished five principal branches of philosophy, Genovese, according to Maurolico, adopted a more explicitly scholastic framework. His scheme separated *philosophia organica* (or logic), regarded as the instrument of all other sciences, from *philosophia realis*, which he in turn divided into *speculativa* and *practica*.[26] The speculative part encompassed metaphysics, physics, and mathematics, while the practical comprised ethics, economics, and politics. This shift toward a more scholastic and pedagogical ordering of knowledge was likely reinforced by the founding of the Jesuit college in Messina in 1548, the *Primum ac Prototypum Collegium Societatis Iesu*. As the prototype of Jesuit education, it promoted a Thomistic framework that valued the hierarchical organization of the sciences, within which Maurolico's reworking of the *divisio scientiarum* naturally found resonance.[27]

The *Sermo* holds a significant place within Maurolico's *oeuvre*, positioned both chronologically and conceptually between two key programmatic statements: specifically, the dedicatory letter to Pietro Bembo from 1540, which precedes the first printed edition of the *Cosmographia* (1543), and the letter to Juan de Vega discussed above, which was perhaps intended to open the *Spherica* of 1558. In both letters, Maurolico references the classification of the sciences, a topic treated at length in the *Sermo*. Furthermore, in the intervening years between the *Philosophiae divisio* of 1528 and the *Sermo*, Maurolico's scholarly and research agenda had become more comprehensive, ambitious, and systematic than the program initially outlined in the preface to the *Grammaticorum*. He had, in fact, been working proficiently on Euclid, Jordanus Nemorarius, Archimedes, Serenus, Autolycus, Theodosius, Menelaus, Boethius, and Apollonius, in addition to making substantial progress in his studies on *De momentis aequalibus*.[28] All these strands of research, which alongside his original investigations constituted a full program for the restitution and reform of mathematical knowledge, are integrated into the classificatory schema derived from Genovese within the *Sermo*.[29]

(Venetiis: impressit Aldus Manutius, 1501), I, chs. 2–4 and 7–14.

25 Very little is known about Giacomo Genovese apart from what Maurolico himself states in the *Sermo*, namely, that he was a priest of Nolan origin and a pupil of Lascaris.

26 The designation *philosophia organica* (from Aristotle's *Organon*) is found in Jean de Jandun's commentary on Aristotle's *De anima*, which was published several times in Venice starting from 1473, and most notably in 1497, cfr. Jean de Jandun, *Quaestiones super tres libros Aristotelis De Anima* (Venetiis: impressit Simon de Luere, 1497).

27 On the relationships between Maurolico and the Jesuits see Rosario Moscheo, *I Gesuiti e le matematiche nel secolo XVI. Maurolico, Clavio e l'esperienza siciliana* (Messina: Società Messinese di Storia Patria, 1998).

28 Cfr. Clagett, "The Works of Francesco Maurolico," 252–163.

29 Cfr. Antonio Carlo Garibaldi, "I programmi di ricerca mauroliciani," in *Archimede e le sue fortune*, ed. by Vincenzo Fera, Daniela Gionta, and Antonio Rollo (Messina: Centro internazionale di studi umanistici, 2014), 567–588, 570–583.

Primary Distinction	Secondary Division	Tertiary Division	Component Disciplines and Key Features
Instrumental	*Philosophia Organica*	*Logica*	*Grammatica*, *Rhetorica*, *Dialectica*.
Real	*Philosophia Realis Speculativa*	*Metaphysica*	Theology (Highest Abstraction).
		Physica	Natural Philosophy (Motion, Matter, from *Libri octo physicorum* to *Medicina*).
		Mathematica	Pure Mathematics; Applied Mathematics (e.g., *Archimedis De aequiponderantibus*).
	Philosophia Realis Practica	*Activa* (Moral)	*Ethica*, *Oeconomica*, *Politica*.
		Factiva (Productive)	Mechanical Arts, including *Medicina*.
Final Placement of Mixed Sciences	Mathematics/ Applied	N/A	Derived arts (*alias artes*): *Computus*, *Musica*, *Astronomia*, *Doctrinam Momentorum* (Mechanics).

Tab 2. – The classification in the *Sermo* (1554).

Another *philosophiae divisio* is introduced by Maurolico as part of the preface to the *Problemata mechanica* (posthumously published 1613), a work he started working on at least during the 1540s as part of a broader programme to provide mathematical foundations for physics and mechanics.[30] In the prefatory section, before addressing the mechanical questions, Maurolico briefly discusses a possible classification of sciences, recalling the same scheme outlined in the *Sermo*, suggesting that the two texts were written around the same period. Here, however, the division serves a new purpose: to define the disciplinary place of mechanics within the hierarchy of the sciences. Consequently, Maurolico divides *philosophia realis* as follows:

> Realis autem philosophiae pars dividitur in operativam et contemplatricem, hoc est in activam, sive practicam et in theoricam, sive speculativam.[31]

[30] Francesco Maurolico, *D. Francisci Maurolyci Abbatis Messanensis Problemata Mechanica cum Appendix et ad Magnetem et ad Pixidem Nauticam pertinentia, Omnia nunc primum in lucem edita* (Messanae: Ex Typographia Petri Brae, 1613). On this work, see "*Problemata mechanica*," in *Edizione Nazionale dell'opera matematica di Francesco Maurolico*, section "12.C.1 Mechanica et machinae – 1. Problemata mechanica," ed. by Hervé Barthélemy & Veronica Gavagna, https://maurolico.it/Maurolico/sezione.html?path=12.C.1

[31] Maurolico, *Problemata Mechanica*, 1613, 7.

He further specifies that mathematics, being speculative, is itself divided into arithmetic (*de quantitate discreta*) and geometry (*de quantitate continua*); and under geometry he explicitly places mechanics, along with optics, astronomy, and other *scientiae mediae*. This concise taxonomy closely echoes the *Sermo de divisione artium*, but with an important new nuance: mechanics is now formally integrated into the mathematical sciences as a discipline concerned with the action of natural causes upon quantified bodies – a hybrid of mathematical reasoning and physical reality.[32]

Primary Division	Secondary Division	Tertiary Division	Placement and Role of Mathematics and Mechanics
Ars Disserendi	N/A	*Logica*	Instrument/Mode of Knowing (*terminus, propositio, syllogismus*).
Realis Operativa	*Activa* (Moral)	*Moralis Doctrina*	Ethics, Politics (Morals and administration).
	Factiva (Productive)	*Artes Banausicae*	Manual/Mechanical Arts (Low status).
Realis Speculativa	*Metaphysica*	N/A	Separated from matter (God, Intelligences).
	Physica	N/A	Principles and motion of simple and mixed bodies.
	Mathematica	*Geometria; Arithmetica.*	Pure Mathematics generates *Scientiae Mediae*. **Mechanica** is explicitly *collocandam esse sub mathematica* (must be placed under mathematics).
Methodological Demand	N/A	N/A	Mechanics requires *Archimedes' De aequiponderantibus* as the necessary philosophical *praeambulum* (preliminary).

Tab. 3 – The classification in the *Problemata mechanica*.

[32] Ibid., 7–8: "Mathematica versatur circa quantitatem et formam a materia separatam. Atque si quantitas sit continua, ea erit geometria, si discreta, erit arithmetica. Metaphysicae pars una naturas ab omni materia separatas, ut sunt Deus et intelligentiae, considerat; altera in communissimis versatur. In quibus et dialetica, arithmetica deinde, atque geometria materiae alicui applicatae generant alias scientias, quae mediae quodammodo sunt inter mathematicas et naturales, quales sunt musica, astronomia, perspectiva, scientiae ponderum, stereometria, cosmographia, geographia, architectura, pictura, sculptura et omnis ratio mechanica. Quae quoniam a mathematica speculatione derivantur, quamquam particularibus rebus applicatae, mathematicae potius, quam naturales appellari solent et debent. Mechanicam igitur scientiam nemini dubium est, sub mathematica, philosophiae parte, collocandam esse."

Preserved in a unique manuscript dated 1567, the *Compendium de divisione et principiis scientiarum* marks a critical stage in Maurolico's reflection on the order of knowledge.[33] The text opens with the author's statement that, having previously gathered scattered notes on the division, subjects, and principles of the arts, he now intends to rearrange them *in ordinem congruum redacta*.[34] The work appears as a master plan for an encyclopedia of knowledge structured in thirteen short books, very likely intended to support the teaching activity Maurolico initiated that year at the Jesuit college in Messina, and is closely connected to Maurolico's project of publishing his own works, which, by that time lacking solid institutional support, he hoped to accomplish through collaboration with the Jesuits.[35] Today, only the introductory framework survives in the extant manuscript. In the preface, Maurolico distinguishes two chief operations within the sciences, *distinctio* and *introductio*, and proposes to treat the former in the first book and the latter through the remaining ones. As in the *Sermo*, the work proceeds to divide philosophy into *organica* and *realis*, the latter further subdivided into the speculative (mathematics, physics, astronomy, music) and the practical (ethics, politics, economics, mechanics, medicine). While maintaining the framework inherited from Giacomo Genovese, however, Maurolico explicitly acknowledges two alternative models: an Aristotelian scheme, derived from Gregor Reisch's *Margarita philosophica*, which orders the sciences according to their objects and degrees of abstraction; and a Valla-derived model, based on the capacities of the human intellect and the operations of reason.[36]

These three alternative classification systems are proposed as equally legitimate in Maurolico's final text: the preface to the 1575 *De sphaera* in the *Opuscula mathematica*, explicitly titled *Philosophiae divisio*.[37] The *Opuscula mathematica* collects treatises on mechanics, optics, and astronomy. The preface sought to organize this advanced and methodologically heterogeneous corpus, whose content had already dismantled classical divisions. Here, Maurolico presents the three alternatives, which are further illustrated by three accompanying diagrams, without explicitly subscribing to one of them. This multiplicity of incompatible schemes is highly significant. Rather than arguing for one definitive scheme, Maurolico attempts to reconcile them, offering the following assurance to the reader:

[33] Bibliothèque Nationale de France, MS lat. 7471 [ca. 1567], ff. 14r–23r.

[34] BNF, MS lat. 7471, f. 14r.

[35] Moscheo, *I Gesuiti e le matematiche nel secolo XVI*, 149–230.

[36] On Valla's classification, see Nicolò Magnani, "L'enciclopedismo di Giorgio Valla fra umanesimo e scienze esatte: struttura e fonti del *De expetendis et fugiendis rebus*," in *Letteratura e Scienze: Atti delle sessioni parallele del XXIII Congresso dell'ADI (Associazione degli Italianisti), Pisa, 12-14 settembre 2019*, ed. by Alberto Casadei, Francesca Fedi, Annalisa Nacinovich, and Andrea Torre (Roma: Adi editore, 2021), 193–203.

[37] Francesco Maurolico, *D. Francisci Maurolyci Abbatis Messanensis Opuscula mathematica, nunc primum in lucem aedita cum rerum omnium notatu dignarum indice locupletissimo* (Venetiis: Apud Franciscum Francischium, 1575).

> nec te lector ingeniose moveat diversitas positionum: quandoquidem in unaquaque trium divisionum Scientiae, et artes (utcunque disponantur) semper invicem cognatae, et ab eadem radice propagatae consistunt.[38]

Following this philosophical assurance, however, Maurolico immediately proceeds to justify his choice to focus on Astronomy by explicitly referencing the inherited hierarchy of certainty and nobility:

> Quoniam itaque Speculativa pars Philosophiae dividitur in naturalem, Mathematicam, ac Theologiam. Atque Theologia excedit facultatem humanam. Physica vero, propter materiae fluxum, incerta. Idcirco commendatur Mathematica, et praecipue Astronomia, propter certitudinem demonstrationis, et subiecti nobilitatem, ut ait Ptolemaeus. Igitur Astronomiae principia tradituri, praemittemus quaedam geometrica, et necessaria praeambula.[39]

This excerpt concisely encapsulates Maurolico's dilemma. While he asserts the fundamental unity of all knowledge (*ab eadem radice propagatae*), the need to justify his work on Astronomy compels him to choose and defend a specific hierarchy - one that subordinates both the transcendent (Theology) and the uncertain (Physics) to the demonstrative certainty of his own mathematical practice. This practical selection, following the presentation of multiple conflicting schemes, textually demonstrates that the search for a unifying philosophical framework was, in effect, yielding to the methodological demands of his own advanced mathematical research.

IV. Conclusion

Maurolico's inability to settle on a single classification scheme reflects the structural tension between his groundbreaking contributions and the inherited hierarchies of knowledge. In *Photismi de lumine et umbra* (1521–1554, published 1611), Maurolico applied Euclidean geometry to optical phenomena, rigorously modeling refraction, eclipses, and the pinhole effect, thus implicitly demanding recognition of optics as central to mathematical natural philosophy.[40] *De momentis aequalibus*, on the other side, marked a methodological breakthrough in mechanics. Drawing on Archimedean statics, Maurolico applied geometric reasoning to determine centers of gravity for pyramids, paraboloids, and other bodies. His use of the method of moments linked volumes with areas, eroding the Aristotelian distinc-

[38] Maurolico, *Opuscula mathematica*, 1575, 3.

[39] Ibid., 3–4.

[40] See Napolitani and Takahashi, introduction to *Optica*; Bellé, "L'edizione a stampa dei *Photismi*,"; also Giora Hon and Yaakov Zik, "Geometry of Light and Shadow: Francesco Maurolyco (1494–1575) and the Pinhole Camera," *Annals of Science* 64, no. 4 (2007): 549–578.

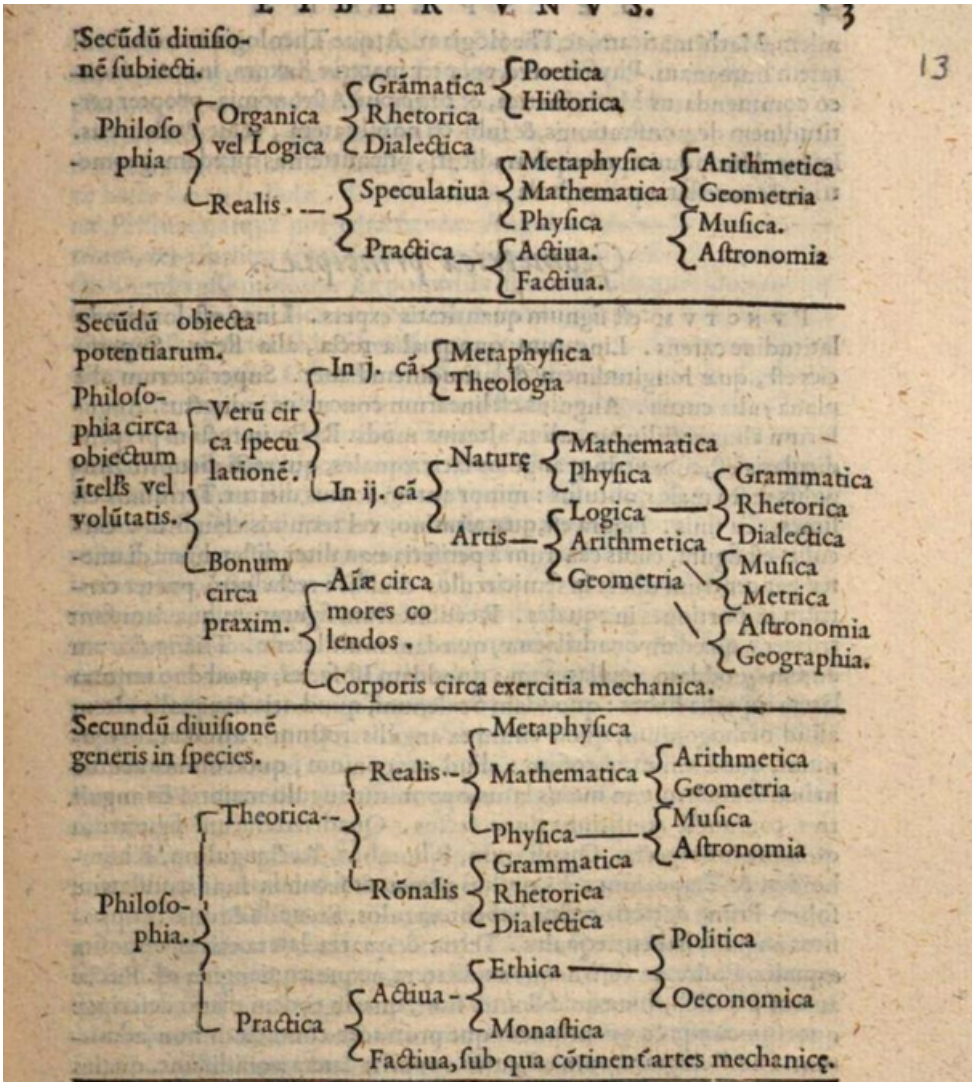

Fig. 1 – The alternatives divisions of sciences in *Opuscola mathematica*.

tion between discrete and continuous quantities.[41] In *Arithmeticorum libri duo* (probably completed by 1557, but published posthumously in 1575), he developed a formal proof by induction, establishing a rigorous recursive structure capable of extending conclusions over infinite sequences. This reconceived arithmetic not merely as the study of discrete quantities but as a field capable of generalized proof, undermining the standard philosophical treatment of numerical reasoning. These innovations, from induction to geometrical mechanics and optics, inherently synthesized domains that traditional classification kept separate, and Maurolico's struggle to reconcile his methods with classical epistemology is most evident in *De scientiarum divisione* of 1575, as the alternatives presented in this work show a persistent internal ambiguity concerning the hierarchy of the sciences.

Scheme Name	Primary Distinction	Key Structural Detail	Placement Crisis
Scheme 1: *Secundum divisionem subiecti* (Subject Matter)	*Organica* / *Realis*	*Musica* and *Astronomia* are listed as species of *Physica*.	Subordinates mathematical arts (*Quadrivium*) to Natural Philosophy.
Scheme 2: *Secundum obiecta potentiarum* (Objects of the Soul's Powers)	*Verum* (Intellect) / *Bonum* (Will)	*Arithmetica*, *Geometria*, *Musica*, *Astronomia* are listed as *Artis* (Arts) under *Verum*.	Demotes core mathematics to an instrumental or practical art.
Scheme 3: *Secundum divisionem generis in species* (Genus into Species)	*Theorica* / *Practica*	*Musica* and *Astronomia* are again subordinated to *Physica* within *Theorica Realis*.	Reinforces the difficulty of granting high theoretical status to *scientiae mediae*.

Tab. 4 – The three alternative schemes and their shortcomings in the *Opuscola mathematica*.

This first scheme classified disciplines by subject matter, subordinating music and astronomy – traditionally Quadrivial subjects – to physics. The second system arranged the sciences by their aims, linking mathematics and physics as "sciences of nature." Yet it paradoxically relegated geometry, arithmetic, and related disciplines to *ars*, instrumental to natural philosophy. This reflects a philosophical tension: Maurolico's innovations demanded theoretical status, yet his schema constrained core mathematics to a practical role, anticipating debates later crystallized by Galileo.[42] The third classification, based

[41] See, for example, the method employed for determining the centre of gravity of the paraboloid: Pier Daniele Napolitani and JeanPierre Sutto, "Francesco Maurolico et la détermination du centre de gravité du paraboloïde de rotation," *SCIAMVS* 2 (2001): 187–250.

[42] See Helen Hattab, "From Mechanics to Mechanism: The *Quaestiones Mechanicae* and Descartes' Physics," in *The Science of Nature in the Seventeenth Century: Patterns of Change in Early*

on genus, repeats the first scheme's pattern, again subordinating astronomy and music to physics. The repetition underscores the impossibility of reconciling mathematical certainty with traditional hierarchies: disciplines demonstratively mathematical yet materially physical could not fit the Aristotelian schema.

Maurolico's classification attempts failed because he tried to fit his methodological breakthroughs into a conservative philosophical structure designed to categorize ancient, abstract quantity. Disciplines such as optics, mechanics, and astronomy combined theoretical principles derived from quantity with empirical observations concerning sensible matter. The classical distinction between the theoretical and the practical sciences provided the traditional hierarchical framework. Maurolico's innovations in *Photismi* and *De momentis aequalibus* showed that these sciences were demonstrative, yet inextricably tied to physical reality. The inability to grant them a consistent, high theoretical status without subordinating them entirely to physics proved the existing framework was inadequate to manage disciplines that were, by their nature, hybrid.

Maurolico's intellectual conservatism, evident in his anti-Copernican stance and his adherence to traditional headings,[43] compelled him to stretch the established Aristotelian framework beyond its logical breaking point. He was attempting to accommodate radical, modern content - mechanics grounded in Archimedean geometry, proof by induction, and mathematically rigorous optics - within a classification system that was designed for purely abstracted quantity. His struggle was structural: the failure was not a conceptual error in classifying but a demonstrable sign that the content being generated had fundamentally surpassed the capacity of the traditional philosophical container.[44] Paradoxically, this conservatism ensured the immediate utility and long-term transmission of his work. By attempting to legitimize his new mathematics within the established scholarly apparatus, he compelled scholars like Clavius and subsequent mathematical practitioners to adopt his enhanced rigor and methodological standards. Maurolico's unsuccessful effort to find

Modern Natural Philosophy, ed. by Peter R. Anstey and John A. Schuster (Dordrecht: Springer, 2005), 99–129.

[43] Edward Rosen, "Maurolico's Attitude toward Copernicus," *Proceedings of the American Philosophical Society* 101, no. 2 (1957): 177–194.

[44] A similar struggle can be recognized in Peter Ramus also. In the first three books of the *Scholae mathematicae*, Ramus sought to defend mathematics against charges of its lack of utility and its obscurity, surveying the history of Greek mathematics and insisting on the practical origins of the subject and on the use to which the ancients had put it, both as a theoretical foundation for natural philosophy and as a practical tool in astronomy and mechanics. Recent developments in astronomy and mechanics showed, by contrast, the sterility of a scholastic natural philosophy devoid of mathematics. See, in this regard, Charles H. Lohr, "The Sixteenth-Century Transformation of the Aristotelian Division of the Speculative Sciences," in Donald R. Kelley and Richard H. Popkin, eds., *The Shapes of Knowledge from the Renaissance to the Enlightenment* (Dordrecht: Springer, 1991), 49–58.

"the right place" for his work served as an explicit, high-level textual document detailing the breakdown of Renaissance epistemology.

Francesco Maurolico's life work encapsulated the central tension of the Renaissance: the obligation to recover ancient knowledge paired with the drive for original discovery. His classification attempts in *De Scientiarum divisione* were an effort to impose an obsolete philosophical order onto a rapidly expanding, methodologically revolutionary corpus of mathematical physics. Maurolico's unsuccessful effort to coherently categorize his new knowledge within the confines of Aristotelian principles provides evidence of the intellectual chasm that had opened between content and structure. This demonstrable failure forced subsequent generations to acknowledge that mathematical knowledge had transcended its classical definition. Encountering the limitations of older methods, Maurolico pioneered a radically new epistemology, one where mathematics was finally elevated from an abstract study of quantity to the demonstrative language of physical reality.

References

Manuscripts

Paris, Bibliothèque Nationale de France=BNF, MS lat. 7471
Paris, Bibliothèque Nationale de France=BNF, Ms. Lat. 7473
Molfetta (Bari), Biblioteca del Seminario Minore Vescovile, 5-7 H 15

Primary printed sources

Archimedes. *Archimēdous tou Syrakousiou, Ta mechri nun sōzomena, hapanta = Archimedis Syracusani philosophi ac geometrae excellentissimi opera, quæ quidem extant, omnia, multis iam seculis desiderata...* Basileae: Ioannes Hervagius excudi fecit, 1544.

Boethius. *De Trinitate.* In *Patrologia Latina*, vol. 64, edited by Jacques-Paul Migne. Paris: Garnier, 1847, col. 1250C.

Isidore of Seville. *Etymologiae*, edited by Wallace M. Lindsay, vol. I. Oxford: Clarendon Press, 1911, II.24.2–3.

Jean de Jandun. *Quaestiones super tres libros Aristotelis De Anima.* Venetiis: impressit Simon de Luere, 1497.

Maurolico, Francesco. *Cosmographia.* Venetiis: apud haeredes Lucaeantonii Iuntae, 1543, epistola dedicatoria.

Maurolico, Francesco. *D. Francisci Maurolyci Abbatis Messanensis Opuscula mathematica, nunc primum in lucem aedita cum rerum omnium notatu dignarum indice locupletissimo.* Venetiis: Apud Franciscum Francischium, 1575.

Maurolico, Francesco. *D. Francisci Maurolyci Abbatis Messanensis Problemata Mechanica cum Appendix et ad Magnetem et ad Pixidem Nauticam pertinentia, Omnia nunc primum in lucem edita.* Messanae: Ex Typographia Petri Brae, 1613.

Maurolico, Francesco. *Grammaticorum rudimentorum libelli sex Francisco Maurolycio authore.* Messanae in freto Siculo: impressit Petrutius Spira, 1528, 7r–7v.

Maurolico, Francesco. *Prologi sive sermones quidam de divisione artium, de quantitate, de proportione,* edited by Graziano Bellifemine. Molfetta [Bari], 1968.

Maurolico, Francesco. *Theodosii Sphaericorum elementorum libri III. Ex traditione Francisci Maurolyci.* Messanae: apud Petrum Spira, 1558, f. 3r.

Reisch, Gregor. *Margarita philosophica.* Freiburg im Breisgau: Johannes Schott, 1503, I, I, ch. 1.

Valla, Giorgio. *Georgii Vallae Placentini De expetendis et fugiendis rebus opus in quo omnes scientiae & artes. Quas tum veterum tum nostrae aetatis scriptorum monumenta nobis tradiderunt...* Venetiis: impressit Aldus Manutius, 1501.

Digital and critical editions

Maurolico, Francesco. *Francisci Maurolyci Archimedea. Tomus A. De Sphaera et Cylindro.* Edited by Riccardo Bellé and Pier Daniele Napolitani. Pisa: Fabrizio Serra Editore (*Edizione Nazionale dell'opera matematica di Francesco Maurolico*), 2021.

Maurolico, Francesco. *Francisci Maurolyci Archimedea. Tomus B. De momentis aequalibus.* Edited by Riccardo Bellé, Pier Daniele Napolitani, and Beatrice Sisana. Pisa: Fabrizio Serra

Editore (*Edizione Nazionale dell'opera matematica di Francesco Maurolico*), 2022.
Maurolico, Francesco. *Francisci Maurolyci Optica.* Edited by Riccardo Bellé and Ken'ichi Takahashi, with an introduction by Pier Daniele Napolitani and Ken'ichi Takahashi. Pisa: Fabrizio Serra Editore (*Edizione Nazionale dell'opera matematica di Francesco Maurolico*), 2017.
Maurolico, Francesco. "Problemata mechanica." In *Edizione Nazionale dell'opera matematica di Francesco Maurolico*, section "12.C.1 Mechanica et machinae – 1. Problemata mechanica." Edited by Hervé Barthélemy and Veronica Gavagna. Accessed November 10, 2025. https://maurolico.it/Maurolico/sezione.html?path=12.C.1

Secondary literature

Andersson, Daniel. "Philosophy and the Renaissance Encyclopaedia." In *Encyclopaedism from Antiquity to the Renaissance*, edited by Jason König and Greg Woolf, 398–413. Cambridge: Cambridge University Press, 2013.
Blair, Ann M. "Organizations of knowledge." In *The Cambridge Companion to Renaissance Philosophy*, edited by James Hankins, 287–303. Cambridge: Cambridge University Press, 2007.
Blair, Ann M. *Too Much to Know: Managing Scholarly Information Before the Modern Age.* New Haven [Conn.]: Yale University Press, 2010.
Blair, Ann M. "Revisiting Renaissance Encyclopaedism." In *Encyclopaedism from Antiquity to the Renaissance*, edited by Jason König and Greg Woolf, 379–397. Cambridge: Cambridge University Press, 2013.
Bellé, Riccardo. "L'edizione a stampa dei Photismi de lumine et umbra (1611) e l'Index lucubrationum." *Nuncius: Annali di Storia della Scienza* 29, no. 1 (2014): 101–134.
Black, Winston. "The Quadrivium and Natural Sciences." In *The Oxford History of Classical Reception in English Literature: Volume 1: 800–1558*, edited by Rita Copeland, 77–94. Oxford: Oxford University Press, 2016.
Crosilla, Maurizio, edited by *Guidobaldo del Monte (1545–1607): Mechanica, Statica, and the Emergence of Mathematical Physics*. Berlin: De Gruyter, 2015.
Damerow, Peter, and Jürgen Renn. "The Transformation of Ancient Mechanics into a Mechanistic World View." In *Transformationen antiker Wissenschaften*, edited by Georg Toepfer and Hartmut Böhme, 243–268. Berlin; New York: De Gruyter, 2010.
Grant, Edward. *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Contexts*. Cambridge: Cambridge University Press, 1996.
Hattab, Helen. "From Mechanics to Mechanism: The Quaestiones Mechanicae and Descartes' Physics." In *The Science of Nature in the Seventeenth Century: Patterns of Change in Early Modern Natural Philosophy*, edited by Peter R. Anstey and John A. Schuster, 99–129. Dordrecht: Springer, 2005.
Hon, Giora, and Yaakov Zik. "Geometry of Light and Shadow: Francesco Maurolyco (1494–1575) and the Pinhole Camera." *Annals of Science* 64, no. 4 (2007): 549–578.
Høyrup, Jens. "Mathematics Education in the European Middle Ages." In *Handbook on the History of Mathematics Education*, edited by Alexander Karp and Gert Schubring, 109–124. New York: Springer, 2014..

Lohr, Carles H. "The Sixteenth-Century Transformation of the Aristotelian Division of the Speculative Sciences." In *The Shapes of Knowledge from the Renaissance to the Enlightenment*, edited by Donald R. Kelley and Richard H. Popkin, 49–58. Dordrecht: Springer, 1991.

Magnani, Nicolò. "L'enciclopedismo di Giorgio Valla fra umanesimo e scienze esatte: struttura e fonti del De expetendis et fugiendis rebus." In *Letteratura e Scienze: Atti delle sessioni parallele del XXIII Congresso dell'ADI (Associazione degli Italianisti), Pisa, 12–14 settembre 2019*, edited by Alberto Casadei, Francesca Fedi, Annalisa Nacinovich, and Andrea Torre, 193–203. Roma: Adi editore, 2021.

Meier, Christel. "Introduction." In *Die Enzyklopädie im Wandel vom Hochmittelalter bis zur Frühen Neuzeit*, edited by Christel Meier, 1–22. München: Fink [Münstersche Mittelalter-Schriften 78], 2002.

Meier, Christel. "Transformationen des Enzyklopädischen Wissensbegriffs." In *Die Enzyklopädie im Wandel vom Hochmittelalter bis zur Frühen Neuzeit*, edited by Christel Meier, 23–44. München: Fink [Münstersche Mittelalter-Schriften 78], 2002.

Napolitani, Pier Daniele. "Archimedes." In *The Cambridge History of Science, Volume 3: Early Modern Science*, edited by Katharine Park and Lorraine Daston, 87–111. Cambridge: Cambridge University Press, 2006.

Napolitani, Pier Daniele, and Jean Pierre Sutto. "Francesco Maurolico et la détermination du centre de gravité du paraboloïde de rotation." *SCIAMVS* 2 (2001): 187–250.

Napolitani, Pier Daniele, and Ken'ichi Takahashi. Introduction to *Francesco Maurolico, Francisci Maurolyci Optica*, edited by Riccardo Bellé and Ken'ichi Takahashi. Pisa: Fabrizio Serra Editore, 2017.

Rose, Paul Lawrence. *The Italian Renaissance of Mathematics: Studies on Humanists and Mathematicians from Petrarch to Galileo*. Genève: Librairie Droz, 1975.

Roux, Sophie. "Forms of Mathematization (14th–17th Centuries)." *Early Science and Medicine* 15, no. 4 (2010): 319–337, 327.

Schmitt, Charles B. *Aristotle and the Renaissance.* Cambridge, MA: Harvard University Press, 1983.

Valleriani, Matteo. "From the Quadrivium to Modern Science." *HoST – Journal of History of Science and Technology* 16, no. 1 (2022): 121–132.

van Dyck, Maarten. "Applying Mathematics to Nature." In *The Cambridge History of Philosophy of the Scientific Revolution*, edited by David Marshall Miller and Dana Jalobeanu, 254–273. Cambridge: Cambridge University Press, 2022.

Westman, Robert S. *The Copernican Question: Prognostication, Skepticism and Celestial Order.* Berkeley: University of California Press, 2011.