Fine, Oronce | Encyclopedia.com

(*b*. Briancon, France, 20 December 1494; *d*. Paris, France, 6 October 1555)

astronomy, mathematics, cosmography.

Fine (Orontius Finaeus Delphinatus) was born in the Dauphiné but spent his scientific career at Paris.[1] His father, François Fine,[2] had attended the University of Paris[3] and practiced medicine in Briançon. Upon his fater's death Fine was sent to Paris and was confided to the care of Antoine Silvestre, regent of the Collège de Montaigu and later of the Collège de Navarre. Although he earned his Bachelor of Medicine degree in 1522,[4] his career developed outside the university; in 1531 he was appointed to the chair of mathematics at the recently founded Collége Royal, where he taught until his death.

From 1515 Fine edited astronomical and mathematical writings for printers in Paris and abroad. Among them were Peuerbach's *Theorkae planetarunu* Sacrobosco's *De sphaera* (1516), and Gregor Reisch's *Margarita philosophiea* (1535), as well as a tract by his grandfather, Michel Fine, on the plague (1522). He also was responsible for an edition of Euclid's *Elements,* of which he published only the first six books (the manuscript of the seventh book, prepared for the printer, is extant).

Fine's first book (1526) was a treatise on the equatorium. an instrument designed to determine the true positions of the planets. In this work Fine exploited the possibilities of curves traced by points (the diagrams of the equations of center), used to facilitate the placement, with respect to the equant. of the mean apsidal line (*auge*)on the epicycle. These curves, drawn on the basis of lists of the equations of center and of the proportional minutes furnished by the Alphonsine Tables, were a very ingenious innovation[5]. At the same time Francisco Sarzosa composed a treatise on the equatorium with the same innovations.* It is difficult to believe that their research was independent, but it is now impossible to establish the proper priority.

Fine wrote four other treatises on the equatorium that are extant in manuscript at the library of the University of Paris (Univ. 149); three treatises are little more than outlines, and the fourth treatise describes an instrument similar to Apian's *Astronomicum Caesarewn,* with the planetary instruments bound as a book (each of them simply reproduces the geometric decomposition of the Ptolemaic theory of epicycles).

Fine's further works on astronomical instruments include trealises on the new quadrant (1527, 1534) and on the astrolabe (incomplete manuscript layouts are in Paris tat 7415 and Univ. 149). These are not innovative and offer only the standard university account. Fine also inserted a treatise on the new quadrant at the end of his work on gnomonics, *De solaribus horologiis et quadrantibus,* which first appeared in 1532 as the concluding section of his *Protomathesis*. The latter consists of four parts, each with its own title page and each separately reprinted: *De solaribus horologiis* has a separate title page dated 1531, but it is not known to exist separately, and it is unlikely that it was distributed by itself. Among the many types of sundials described in this book are a multiple dial and a *navicular*.[6] A very rare ivory *navicula* signed "Opus Orontii F. 1524" —the only scientific instrument certainly attributable to Fine, and perhaps the only one he ever constructed—is in the private Portaluppi collection at Milan.

Besides treatises on instruments. Fine's astronomical work included theoretical writings of a popular nature. These were presented at the two levels of traditional instruction: the elementary one represented by Sacrobosco's *De sphaera,* and the higher one of epicyclic astronomy. The *Cosmogra phia*, an elementary manual, was first published in Latin as the third part of the *Protvmathesis* (1532), with a separate title page dated 1530, and was reprinted several times, both in Latin and French. It includes the description of the fixed celestial sphere used for reference, the essential ideas concerning the astronomy of the *primum mobile* (right and oblique ascensions and the duration of diurnal arcs), and a few brief notions of astronomical geography (climates and terrestrial longitudes and latitudes); but it contains no information on the motions of the planets. The latter were discussed in the *Théorique de cieux* (published anonymously in 1528), which gives a detailed exposition of the Alphonsine epicyclic theory, the first one in French. The brief *Canons… touchatu Vusage… des communs almanacks* (1543) is a succinct explanation of an almanac computed for the meridian of Tübingen (undoubtedly by Johann Stöffler. which exists in editions dated 1531 and 1533).

Although Fine's interest in astronomy extended to astrology, he wrote only minor works on that subject. The *A Imanach* of 1529, actually a calendar giving the dates and hours of the new moons in the nineteen-year cycle and the duration of the diurnal arcs, included a short commentary on medical astrology. *De XII coeli domiciliis* (1553) was a complete theory of the celestial houses, important for casting horoscopes. In this work Fine adopted the definition of the houses advocated by Campanus, for whom the divisions of the celestial vault, for a given horizon, are constructed on the equal divisions of its first

azimuth and converge to the south and to the north of the horizon; following this definition, the one usually employed on astrolabes, the lines of the celestial houses were projected onto the astrolabe in accordance with circles passing through the points of intersection of the horizon and of the meridian. Fine also gave an original definition of the unequal hours, however, which were no longer the equal divisions of the diurnal arc and of the nocturnal arc, but the equal divisions of the ecliptic computed, at each moment, from its intersection with the horizon.

The result, for the construction of the tympana of the astrolabes, was a highly original plotting of the hourly lines -a geometric locus of these equal divisions when the ecliptic turns about the axis of the earth according to the daily movement. Although no astrolabe is known to have been constructed on the basis of this definition, it did find an application in the astrolabic dial of the planetary clock at the Bibliothéque Ste. Genevieve. The dial expressly refers to Fine, and it has therefore been assumed since the seventeenth century that the clock itself was his work. This is highly improbable.[7] It is virtually certain that the clock dates from the fifteenth century and that about 1553 one of its panels, containing the dial of the hours and the astrolabic dial, was replaced by Fine with a panel designed to illustrate his new conception of the unequal hours. The level of technical competence displayed by the mechanism of this dial is very low, for the *araignée* (the stereographic projection of the celestial vault) completes its revolution in a mean solar day and not in a sidereal day.

While the third and fourth parts of the *Proto-mathesis* dealt with astronomy, the first two treated arithmetic and geometry. *De arithmetic practica*the first part, is Fine's only work on arithmetic. In accordance with the traditional schema of medieval arithmetic, the various operations carried out on the numbers were enumerated and described following a plan that distinguished whole numbers, common fractions (fractiones vulgares), and natural or sexagesimal fractions. The latter were of particular interest to practitioners of Alphonsine astronomy, since they were the basis of their preferred mathematical tool. Fine made it easier to work with these fractions by providing a *tabula proportions* (so called because of its aid in computing proportional parts of the equation of the argument). or multiplication table in sexagesimal numeration, similar to the same table by John of Murs or Bian-chini. The last book of the De arithmetica, on ratios and proportions, developed theorems established by Euclid and Ptolemy.

The two books on geometry (dated 1530 in the *Protomathesis*) treated the subject at a more elementary level. After stating the definitions of plane and solid figures, borrowed from the *Elements,* as well as the Euclidean postulates, Fine discussed the measurement of length, height, and width in the tradition of the treatises on practical geometry, of which one of the most popular aspects was geometrical canons for the use of the astrolabe. To this end he treated the geometric square, the quadrant, the cross-staff (Jacob's staff), and the mirror. The calculation of surfaces and volumes, which was the complement of the measurement of lengths, included that of circular surfaces and volumes. For the latter, Fine computed the ratio of the circumference of the circle to its diameter as 22/7.

Returning to the ratio of circumference to diameter in *De quadratura circuli* (1544), Fine offered what he believed to be a more precise value of π: In De circuit mensura, which follows *Dequadratura,* he reduced that ratio to 47/15. Finally, in the posthumous *De rebus mathematicis* (1556), he increased the value slightly to one between the two preceding ones: These attempts to determine the true figure were but one aspect of his efforts to solve the quadrature of the circle, for which he examined several solutions. None of them was satisfactory; and Fine was vehemently attacked by some of his contemporaries, notably Pedro Nuńez Salaciense, in *De erratis Orontii Finaei* (1546), and Johannes Buteo (Jean Borrel), in De quadratura circuli (1559). It must be acknowledged that Fine's arrogance about his own accomplishments undoubtedly made his errors of logic all the more intolerable to his opponents.

Fine's work in trigonometry scarcely went beyond what was necessary to establish a table of sines: three chapters of book II of *De geometria,* included in the *Protomathesis,* and *De rectis in circuli quadrante subtensis* and *De universali quadrante,* both published in 1542 as appendixes to the first reprinting of *De mundi sphaera* (which had been included in the Protomatlwsis). Although the works of Regiomontanus and Copernicus on this subject were printed during Fine's lifetime, his writings fell entirely within the Ptolemaic tradition. For example, he limited himself to demonstrating the properties that allow successive evaluations of the half chords of arcs starting from the half chords of some other noteworthy arcs. Also, the table of sines that he constructed for intervals of fifteen minutes and a radius of sixty units is very similar to that (for example) of Fusoris.[8] Nevertheless, Fine indicated how his sines, expressed in sexagesimal notation, may be transformed into those given by Regiomontanus, which were calculated with a radius of 60,000 units.

The universal quadrant described in 1542 was the trigonometric quadrant deriving from the eleventh-century *quadrans vetustissimus*. This earlier instrument had been described and commented upon by Apian in his *Instrumentum… primi mobilis* (1534). Fine dealt only with the strictly trigonometric uses of the quadrant, determination of the right and versed sines of a given arc—or vice versa-and the products or ratios of two sines. Virtually ignoring the application of its properties to astronomical calculations—a task carried out by J. Bonie and by B. de Solliolis in works that Fine owned[9]-Fine did no more than enumerate these possibilities.

In his Latin thesis of 1890, L. Gallois dealt only with Fine's cartography: a large map of France on four sheets and two cordiform world maps, one of the eastern hemisphere and the other, doubly cordiform, of the northern and southern hemispheres. Gallois held that the world maps were original creations and provided the source of the similar maps executed by Schoner and Apian.[10] This hypothesis is unlikely: and in the absence of an established chronology of these maps, it may be supposed that the relations of dependence were in fact the reverse, for Fine's usual procedure was to elaborate his astronomical works on the basis of the writings of others. This was undoubtedly the case with his map of France, but the scarcity of the

surviving documents does not allow its genesis to be reconstructed. Fine's map of France does not truly comprise the grid of the parallels and meridians but, rather, transfers the schema to the margins; the longitudes are computed there from *l'extremité occidentale du mande* as in the Alphonsine Tables.

Fine's scientific work may be briefly characterized as encyclopedic, elementary, and unoriginal. It appears that the goal of his publications, which ranged in subject from astronomy to instrumental music, was to popularize the university science that he himself had been taught. In this perspective, it is perhaps his works in French (such as *Théorique des vieux*) or the French translations of his works first published in Latin (for instance, *Canons et documents très amples touchant l'usage des communs almanacks* and the *Sphére du monde*) that best illustrate his scientific career.

NOTES

1. There is disagreement as to whether the last letter of his name should be accented. Citing the Latin form Finaeus, bookkeeping records in which the name is spelled Finee, and the bad rhyme of Finé with Dauphiné and *affiné* made by André Thevet, L. Gallois (*De Orontio Finaeo, 2*) opted for the pronunciation Finé. This is the one that has generally been accepted, despite the objections of Dauphinois scholars, who, citing local usage —which ought to decide the question—prefer Fine. The form Finée probably resulted from rendering the Latin form into French. As for Thevets rhymes, which are very late (1584). their significance is diminished by the fact that a contemporary and close friend of Fine's. Antoine Mizauid, rhymed Fine with *doctrine in* his verses. (See MS Paris fr. 1334. fol. 17.) The date of his birth is specified in an autograph note in MS Paris lat. 7147. fol. ii.

2. See E. Wickersheimer, *Dictiannatrc biouraphique des médecins en France au moyen âge* (Paris, 1936). 553 and 154

3. There are two MSS of a course on Aristotle given by Jean Hannon and copied by François Fine in 1472- 1473 (Paris lat. 6436, 6529); see *Catalogue des manuscriu en écriturc latine portant des indications de date, de lieu ou de copiste* II (Paris. 1962). 341,353; pi. cli.

4.*Commenta'tres de la Fuculté de médecine de I'Université de Paris*,**II,** 1516-1560, M.-L. Concasty. ed. (Paris, 1964). 50b. 54a. This is in the series Collection de Documents Inédits sur *I* His to ire de France.

5. E. Poulle and Fr. Maddison. "Un équatoire de Franciscus Sarzosius." in *Physis*,**5** (1963), 43-64.

6. D. J. de Soila Price. "The Little Ship of Venice, a Middle English Instrument Tract," in *Journal of the History of Medicine and Allied Sciences*.**15** (1960), 399-407: and Fr. Maddison, *Medieval Scientific Instruments and the Development of Navigational Instruments in the XVth and XVlth Centuries* (Coimbia, 1969). 14, This book is Agrupa-mento de Estudos de Cartografia Antiga, XXX.

7. D. Hillard and E. Poulle, "Oronee Fine et I'horloge planétaire de la Bibliothèque Sainte-Geneviève" and E. Poulle, "l..es mécanisations de rastronomie des épicycles, I'horloge d'Oronce Fine." in *Comptes rendus des séances de Académie des inscriptions et belles-lettres* (1974). 59-79.

8. E. Poulle. *Un constructed d'instruments astronomiques au X'i c siècle.Jcan Fusam* (Paris, 1963). 75-80. This work is Bibliothèque dc "I École Pratique des Hautes Études, IV'" sect.. Ease. 318.

9. E. Poulle, "Théorie des planètes et trigonométric au XVe siècle d'après un équatoire inédit. Ic sexagenarium." in *Journal des savants* (1966). 129- 161.esp. 131- 132.

10. L. Gallois, *Les géographes allemands de la renaissance* (Paris, 1890), 92-97. This work is Bibliothèque de ia Faculté des Lettresde Lyon. XIII.

BIBLIOGRAPHY

I. Original Works. The list of books published by Fine is difficult to establish, for it involves sorting out many reprintings, some of them only partial, and a number of translations. There are four contemporary lists, three of them inserted in his eds. of Euclid's *Elements* of 1536, 1544, and 1551; the fourth was included by An-toine Mizauld in his ed. of Fine's *De rebus mathematics* in 1556. All of these lists, however, pose problems. That drawn up by L. Gallois in *De Orontio Finaeo gallico geographo* (Paris. 1890). 71 -79. is incomplete and has been superseded by those of R. P. Ross, in his unpublished doctoral dissertation, "Studies on Oronce Fine (1494-1555)" (Columbia University. 1971); and of D. Hiilard and E. Poulle, in "Oronee Fine et I'horloge planetaire de la Bibliothéque Sainte-Geneviève," in *Bi-hliotheque d'humanisme et renaissance*,**33** (1971), 311-351, see 335-351. The latter list is numbered and indexed, and includes MSS. One should consult the latest findings concerning the bibliography in R. P. Ross, "Oronce Fine's Printed Works: Additions to Hillard and Poulle's Bibliography." in *Bihliotheque d'humanisme et renaissance*. 36 (1974), 83-85.

II. Secondary Literature. Gallous's*De Oromio Finaeo*has become quite dated and presents an extremely limited picture of Fine's work. Ross's "Studies on Oronce Fine (1494-1555)" deals only with the mathematical works, among which those on astronomy are not included. It does, however, contain a recent bibliography. An overall account of Fine's work is in the exposition catalog of the Bibliotheque Ste.-Genevieve, *Science et astrologie an XVIe Siècle. Or Once Fine et son harloge planétaire* (Paris, 1971).*See also* Richard P. Ross, "Oronce Fine's De minibus libri II: The First Printed Trigonometric Treatise of the French Renaissance," in *Isis,* 66 (1975), 378-386.

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