The Commentaries of Proclus on the First Book of Euclid's Elements of Geometry Translated by Thomas Taylor (London, 1792) Book I, Chapter 13

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CHAP. XIII.

Another Division of the Mathematical Science, according to Geminus.

AGAIN, some think (among whom is Geminus) that the mathematical science is to be divided in a different manner from the preceding. And they consider that one of its parts is conversant with intelligibles only, but the other with sensibles, upon which it borders; denominating as intelligibles whatever inspections the soul rouses into energy by herself, when separating herself from material forms. And of that which is conversant with intelligibles they establish two, by far the first and most principal parts, arithmetic and geometry: but of that which unfolds its office and employment in sensibles, they appoint six parts, mechanics, astrology, optics, geodæsia, canonics, and logistics, or the art of reckoning. But they do not think that the military art, or tactics, should be called any one part of mathematics, according to the opinion of $some^{23}$; but they consider it as using at one time the art of reckoning, as in the numbering of legions; but at another time geodæsia, as in dividing and measuring the spaces filled by a field of camps. As, say they, neither the art of writing, nor the art of healing, are any part of mathematics, though frequently both the historian and physician use mathematical theorems. This is the case with historians indeed, when relating the situation of climates, or collecting the magnitudes and dimensions of cities, or their compass and circuit: but with physicians, when elucidating by ways of this kind, many things in their art. For Hippocrates himself shews the utility derived to medicine from astrology, and almost all who speak of opportune times and places. By the same reason he also, who accommodates his work to tactics, uses indeed mathematical theorems, yet is not on this account a mathematician, although he is sometimes willing that a numerous camp should exhibit a very small multitude, and forms his army according to a circular figure; but sometimes in a quadrangular, quinquangular, or some

 $^{^{23}}$ I am afraid there are few in the present day, who do not consider tactics as one of the most principal parts of mathematics; and who would not fail to cite, in defence of their opinion, that great reformer of philosophy, *as he is called*, Lord Bacon, commending pursuits which come home to men's businesses and bosoms. Indeed, if what is lowest in the true order of things, and best administers to the vilest part of human nature, is to have the preference, their opinion is right, and Lord Bacon is a *philosopher*!

other multiangular figure, when he desires it to appear numerous. But since these are the species of the whole mathematical science, geometry is again divided into the contemplation of planes, and the dimension of solids, which is called stereometry. For there is not any peculiar treatise about points and lines, because no figure can be produced from these without planes or solids. For geometry treats of nothing else in every one of its parts, than that it may constitute either planes or solids: of that when constituted, it may compare and divide them among themselves. In like manner, arithmetic is distributed into the contemplation of linear, plane and solid numbers. For it considers the species of numbers separate from sensible connections, proceeding from unity, and the origin of plane numbers; I mean of the similar, dissimilar, and solid, even to the third increase. But geodæsia, and the art of reckoning, are divided similarly to arithmetic and geometry, as they do not discourse concerning intelligible numbers or figures, but of such as are sensible alone. For neither is it the office of geodesia to measure the cylinder or the cone, but material masses as if they were cones, and wells as if they were cylinders. Neither does it accomplish this purpose by intelligible right lines, but by such as are sensible, sometimes indeed by a more certain means, as by the solar rays: but at other times by grosser ones, as by a line and perpendicular. In like manner, the reckoner does not survey the passions of numbers by themselves, but as they are resident in sensible objects. From whence he also imposes a name upon these derived from the things which he reckons, calling them $\mu\eta\lambda(\alpha)$, & $\phi(\alpha\lambda(\tau\alpha))$. Besides this, he does not admit of any least, like the arithmetician, who receives that minimum, as a genus of relation. For some man is considered by him as the measure of the whole multitude of men, as unity also is the common measure of all numbers. Again, optics and canonics are produced from geometry and arithmetic. And optics uses the visual rays which are constituted by the rays of the eyes, as lines and angles. But it is divided into that which is properly called optics (because it renders the cause of those appearances, which are accustomed to present themselves to us different from their reality, on account of the different situations and distances of visible objects, as the coincidence of parallel lines, or the appearance of quadrangles as if they were circles); and into universal catoptrics, which is conversant about various and manifold refractions, and is connected with imaginitive or conjectural knowledge: as also into that which is called sciography²⁴, or the delineation of shadows, which shews how appearances in images may seem neither inelegant nor deformed, on account of the distances and altitudes of the things designed. But canonics (music)

 $^{^{24}}$ By this is to be understood the art now called Perspective: from whence it is evident that this art was not unknown to the ancients, though it is questioned by the moderns.

or the regular art, considers the apparent reasons of harmonies, finding out the sections of rules, every where using the assistance of sense, and, as Plato says, seeming to prefer the testimony of the ears to intellect itself. But to the parts we have hitherto enumerated, mechanics must be added, as it is a certain part of the whole science, and of the knowledge of sensible objects, and of things united with matter. But under this exists the art effective of instruments, which is called (ὀργανοποιητική) I mean of those instruments proper for the purposes of war: such, indeed, as Archimedes is reported to have constructed, resisting the besiegers of sea and land; and that which is effective of miracles, and which is called $(\vartheta \alpha \cup \mu \alpha \tau \circ \pi \circ \eta \tau i \varkappa \eta)$. One part of this constructs with the greatest artifice pneumatic engines, such as Ctesibus and Heron fabricated: but another operates with weights, the motion of which is reckoned to be the cause of inequilibrity; but their station of equilibrity, as Timæus also has determined: and again, another part imitates animate foldings and motions by strings and ropes. Again, under mechanics is placed the knowledge of equilibriums, and of such instruments as are called centroponderants: also $(\sigma \varphi \alpha \rho \sigma \pi \sigma \alpha \alpha)$ or the art effective of spheres, imitating the celestial revolutions, such as Archimedes fabricated; and lastly, every thing endued with a power of moving matter. But the last of all is astrology, which treats of the mundane motions, of the magnitudes of the celestial bodies, their figures and illuminations, their distances from the earth, and every thing of this kind; assuming many things indeed to itself from sense, but communicating much with the natural speculation. One part of this is gnomonics, which is exercised in settling the dimension of hororary gnomons: but the other is metheoroscopics, which find out the differences of elevations, and the distances of the stars, and also teaches many other and various astrological theorems. The third part is dioptrics, which ascertains by dioptric instruments of this kind the distances of the sun and moon, and the five other stars. And such is the account of the parts of the mathematical science, delivered by the ancients, and transmitted to our memory by the informing hand of time.