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Amministrazione e abbonamenti
Uffici di Pisa
Via Santa Bibbiana 28, I 56127 Pisa,
tel. +39 050 542332, telefax +39 050 574888, fse@libraweb.net

Uffici di Roma
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STUDI

THE MANY WAYS TO PHILOSOPHICAL HAPPINESS IN RENAISSANCE ITALY: INTELLECT, SALVATION AND TRANSLATION

PARTS, WHOLES, AND MATTER IN EARLY MODERN NATURAL PHILOSOPHY: MEREOLOGICAL PERSPECTIVES

INDIVISIBLES, PARTS, AND WHOLES IN RUBIO'S *TREATISE ON THE COMPOSITION OF CONTINUUM* (1605)

Simone Guidi

Abstract · In this paper I reconstruct and discuss Antonio Rubio (1546-1615)'s theory of the composition of the continuum, as set out in his *Tractatus de compositione continui*, a part of his influential commentary on Aristotle's *Physics*, published in 1605 but rewritten in 1606. Here I attempt especially to show that Rubio's is a significant case of Scholastic overlapping between Aristotle's theory of infinitely divisible parts and indivisibilism or 'Zenonism', i.e. the theory that allows for indivisibles, extensionless points, lines, and surfaces, which are supposed to take part in the composition of the continuum. Even if such a syncretic tendency was, in many different ways, already developing in the medieval period and then at the end of the sixteenth century, Rubio's position is indeed peculiar. He maintains that indivisibles are real and actual, infinite in act, really distinct from each other, and that, although they indwell in substance, indivisibles do not contribute directly to the constitution of the continuum. In this reconstruction I emphasize notably Rubio's usage of mereological notions like those of part, whole, completeness and incompleteness.

Keywords · Early Modern Scholasticism, Composition of *continuum*, Indivisibles, Infinity, Parts and Wholes.

Introduction

Famously, the problem of the composition of the continuum is at stake in some of the main debates that challenged philosophers and scientists over the entire seventeenth century. Yet scholarly reconstructions[1] have

simone.guidi@cnr.it, iliesi-cnr, Roma, Italia.

[1] See U. Baldini, *La scuola galileiana*, in *Scienza e tecnica nella cultura e nella società dal Rinascimento a oggi*, ed. by G. Micheli, Torino, Einaudi, 1980, pp. 383-552; Idem, Legem impone subactis. *Studi su filosofia e scienza dei Gesuiti in Italia*, Rome, Bulzoni, 1992; Idem, *Boscovich e la tradizione gesuitica in filosofia naturale: continuità e cambiamento*, «Nuncius», vii, 2, 1992, pp. 3-67. See also A. Alexander, *Infinitesimal: How a Dangerous Mathematical Theory Shaped the Modern World*, New York, Scientific American-Farrar-Straus and Giroux, 2014, part i; P. Beeley, *Kontinuität und Mechanismus: zur Philosophie des jungen Leibniz in ihrem ideengeschichtlichen Kontext*, Stuttgart, Steiner, 1996; J. Dhombres, *Could or Should Gregory of Saint-Vincent Use Cavalieri's Indivisibles to Present His Own Quadrature of the Hyperbola that Led to the Logarithm and to the Exponential?*, in *Seventeenth-Century Indivisibles Revisited*, ed. by V. Jullien, Cham, Birkhäuser-Springer, 2015, pp. 137-164; J. Meskens, *Between Tradition and Innovation Gregorio a San Vicente and the Flemish Jesuit Mathematics School*, Leiden-Boston, Brill, 2021.

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clearly shown that it also instantiates a particular kind of issues, i.e. those which, in the early modern age, link problems emerging within the Schools to the novelties of the time; in this specific case, the rediscovery of Greek mathematics and the rise of new scientific approaches.

Decades before Cavalieri's *Geometria* of 1635, and even before the Jesuitic banning of the indivisibles in 1632, discussions about the metaphysics and the mathematics of indivisibles were in fact already going on.[1] At the same time, the Schools had to face, even internally, the increasing popularity of indivisibilism, in both its two possible faces they believed it was rejected by Aristotle.[2] On the one hand, atomism; on the other hand, what seventeenth-century Scholastics labeled as 'Zenonism',[3] i.e. the anti-Aristotelian theory that allows for indivisible, extensionless points, lines, and surfaces, which are supposed to take part in the composition of the continuum.

Both these forms of indivisibilism were growing not only among non-Aristotelian natural philosophers, but even within the Schools themselves, based

[1] See P. Rossi, *I punti di Zenone. Una preistoria vichiana*, «Nuncius», XIII, 1998, pp. 378-425; Alexander, *Infinitesimal*, cit., part I; D. Sherry, *The Jesuits and the Method of Indivisibles*, «Foundations of Science», XXIII, 2018, pp. 367-392.

[2] As noted by J. E. Murdoch, *Beyond Aristotle: indivisibles and infinite divisibility in the later Middle Ages*, in *Atomism in Late Medieval Philosophy and Theology*, ed. by Ch. Grellard, A. Robert, Leiden-Boston, Brill, 2009, pp. 15-38, in *Physics*, VI, «atoms or indivisibles [that Aristotle] considered and combatted were extensionless, a conception that can be found in scholastic debate about atoms all the way to Galileo and his *atomi non quanti*» (p. 15). According to A. Robert, *Atomism*, in *Encyclopedia of Medieval Philosophy. Philosophy between 500 and 1500*, ed. by H. Lagerlund, 2nd edition, Cham, Springer, 2011, pp. 219-225, «after the thirteenth century, the main sourcefor this renewal […] were not Epicurus or Lucretius, but rather Democritus» (p. 222a), thanks also to new translations into Latin of Aristotle's works dealing with continua and divisions. On Aristotle anti-indivisibilism (whose target, as noted by P. S. Hasper, *Aristotle's Diagnosis of Atomism*, «Apeiron», XXXIX, 2006, pp. 121-155, is *conceptual*, more than physical indivisibility) see D. Furley, *Two Studies in Greek Atomists*, Princeton, Princeton UP, 1967, 57-130; F. Miller, *Aristotle Against the Atomists*, in *Infinity and Continuity in Ancient and Medieval Thought*, ed. by N. Kretzmann, Ithaca-London, Cornell UP, 1982 pp. 87-111; R. Sorabji, *Time, Creation and the Continuum: Theories in Antiquity and the Early Middle Ages*, London, Duckworth, 1983, part V, pp. 321-383; B. M. Sattler, *Divisibility or Indivisibility The Notion of Continuity from the Presocratics to Aristotle*, in *The History of Continua Philosophical and Mathematical Perspectives*, ed. by S. Shapiro, G. Hellman, Oxford, Oxford UP, 2021, pp. 6-26.

[3] See P. Rossi, *I punti di Zenone*. Rossi concentrates especially on Zenonism following the traces of such an expression he found in Pierre Bayle's *Dictionary*, and as the source of the later theory of 'inflated points'. He thereby reconstructs the positions of Pedro Hurtado de Mendoza, Rodrigo de Arriaga, and Francisco de Oviedo, considering all of them as Zenonists. However, that seems not to be the case, since Hurtado and Oviedo actually subscribe to a midway view similar to that of Rubio, which I reconstruct here. See also Sherry, *The Jesuits and the Method of Indivisibles*, cit., and, on later cases of Jesuitic debates, see C. R. Palmerino, *Two Jesuit Responses to Galilei's Science of Motion: Honoré Fabri and Pierre Le Cazre*, in *The New Science and Jesuit Science: Seventeenth Century Perspectives*, ed. by M. Feingold, Dordrecht, Kluwer, 2002, pp. 187-227.

on controversies that had already started in the late Middle Ages.[1] Already at the end of the sixteenth century, Zenonism in particular started meeting the increasing dissatisfaction with Aristotle's account of the continuum, calling into question especially the traditional argument that no indivisible, being extensionless and partless, could be ordered consectively to another one and compose an extended magnitude by addition.[2] Among the early Jesuits, Francisco Toledo reports in his commentary on the *Physics*, dated 1573, clues of the popularity reached by indivisibilism in the sixteenth century:

> non desunt […] nostra aetate qui opinionem illam antiquorum, quos impugnat Aristoteles[,] probabilem putent, et conentur solvere rationes omnes contrarias Aristotelis.[3]

Those unidentified supporters of *indivisibilia* are not pure Zenonists and are known especially for defending a peculiar distinction among the parts of the continuum. The latter would result indeed from the combination of extensionless indivisible parts (*partes primae*). These indivisibles are the responsible also for that peculiar contiguity of such divisible extended parts (*partes secundae*), out of which the continuum effectively results –[4] i.e. indi-

[1] See J. E. Murdoch, *Infinity and continuity*, in *Cambridge History of Later Medieval Philosophy*, ed. by N. Kretzmann, A. Kenny, J. Pinborg, Cambridge, Cambridge up, 1982, pp. 564-591. Here (p. 576) Murdoch stresses that late medieval indivisibilism is mainly «devoted to arguing against the Aristotelian position and to establishing that continua can be composed in this or that fashion of indivisibles», so that «there seems to be no sign of a resurgence of ancient physical atomism among these late medieval indivisibilists, nor anything resembling a consciously atomistic interpretation of mathematics». See also Idem, *Beyond Aristotle: indivisibles and infinite divisibility in the later Middle Ages*, and J. Celeyrette, *From Aristotle to the Classical Age, the Debates Around Indivisibilism*, in *Seventeenth-Century Indivisibles Revisited*, cit., pp. 19-30.

[2] This argument, largely used by medieval and early modern Schoolmen, draws from Aristotle, *On Generation and Curruption*, I, 316a 23-34: «if it [i.e. a body] consists of points, it will not possess any magnitude. For when the points were in contact and coincided to form a single magnitude, they did not make the whole any bigger (since, when the body was divided into two or more parts, the whole was not a bit smaller or bigger than it was before the division); hence, even if all the points be put together, they will not make any magnitude»; see also *Physics*, III, 6, 206b16-22, and the pseudo-Aristotelian *On Indivisible Lines*, 971a 22-26: «a line is a magnitude; but the putting together of points constitutes no magnitude, because several points put together occupy no more space than one. For when one line is superimposed on another and coincides with it, the breadth is in no way increased. And if points too are contained in the line, neither would points occupy more space. Hence points would not constitute a magnitude» (both trans. from Barnes edition). As for the arguments contained in the *On Indivisible Lines* see Sorabji, *Time, Creation and the Continuum*, cit., pp. 343-345 and Hasper, *Aristotle's Diagnosis of Atomism*, cit.

[3] F. Toledo, *Commentaria in octo libros Aristotelis de Physica auscultatione*, Venetiis, apud Iuntas, 1573, VI, c. 2, t. 23, q. 1, f. 175*v*, col. 2.

[4] According to Aristotle (*Physics*, V, 3, 227a 14-15) continuity is a specific kind of contiguity, which «belongs to things that» are mutually consecutive and «naturally in virtue of their mutual contact form a unity» (trans. from Barnes edition).