

Foreword

Part-whole theories, or mereologies (from the Greek word *μέρος*, meaning: “share”, “portion”, or “part”), form a central chapter of metaphysics throughout its history. Their roots can be traced back to the earliest days of philosophy, beginning with the Pre-Socratics. It is plausible to hold that Parmenides argues that there can be no parts, thus everything there is is one whole; and Zeno argues for his striking paradoxes on the assumption that there are parts (whether spatial or temporal ones). Democritus introduces the idea that everything consists of *atoms* (literally: “indivisibles”) which are themselves simple, i.e., partless; Anaxagoras, on the other hand, maintains that everything consists of basic *stuffs* which are infinitely and homogeneously divisible: any portion of such a stuff is the same sort of stuff, and any portion, no matter how small, can be divided into further such portions. Sophisticated analyses in terms of parts and wholes figure prominently in the writings of Plato (especially in the *Phaedo*, *Republic*, *Theaetetus*, *Parmenides*, *Timaeus*, and *Philebus*) and Aristotle (most notably in the *Metaphysics*, but also throughout his logical, natural philosophical, and even his ethical treatises). And in Hellenistic times, both the Epicureans and the Stoics rely on mereologies—and claims about the kinds of parts and wholes that exist—in order to frame certain of their central theses. The interest in mereologies continues throughout the philosophy of antiquity, as evidenced, e.g., by Neoplatonist thinkers like Plotinus and Proclus.

Boethius played a crucial role in transmitting ancient thought to the Middle Ages; and in works such as *De Divisione* and *In Ciceronis Topica* (and in his translations of Aristotle’s *Categories* and *Topics*) he made mereological claims and questions available to early medieval philosophy. These were taken up by, for example, Peter Abelard (and his immediate predecessors and contemporaries). The introduction of the bulk of Aristotle’s writings to the Latin West provided a major impetus to Scholasticism in all areas of philosophy. Thus familiar figures like Thomas Aquinas, John Duns Scotus, William of Ockham, and Jean Buridan—as well as many far less well-known thinkers, whose works are only now beginning to be explored—offer ingenious treatments of subtle ontological questions by drawing on, e.g., Aristotle’s *Metaphysics*, and using the lessons they learned there for their own ends. Here, too, mereological considerations often play a leading part.

Mereologies occupy a prominent place also in early modern philosophy. Some examples, taken almost at random: Jungius's *Logica Hamburgensis* (1638), Leibniz's *Dissertatio de arte combinatoria* (1666) and *Monadology* (1714), and Kant's early writings (especially the *Monadologia physica* of 1756). (Such a list could obviously be substantially lengthened.)

But as fully rigorous theories of part-whole relations, i.e., of the relations of part to whole and the relations of part to part within a whole, mereologies made their way into our times mainly through the work of Franz Brentano and that of his pupils, especially Edmund Husserl. The third of Husserl's *Logical Investigations* (1901) may rightly be considered the first attempt at a thorough formulation of a full-fledged theory, though in a format that makes it difficult to disentangle the analysis of mereological concepts from that of other notions (such as the relation of ontological dependence). It is not until Stanisław Leśniewski's *Podstawy ogólnej teorii mnogości* (Foundations of a General Theory of Sets, 1916) that a pure theory of part-whole relations was given an exact formulation. Yet because Leśniewski's work was largely inaccessible to non-speakers of Polish, it is only with the publication of Henry Leonard and Nelson Goodman's *The Calculus of Individuals* (1940) that mereology has become a chapter of central interest for modern philosophers. Indeed, although Leśniewski's and Leonard and Goodman's theories come in different logical guises, they are sufficiently similar to be recognized as a common basis for most subsequent developments, a single theory often referred to as "classical mereology".

As it turns out, however, just how *classical* classical mereology is, and how plausible it is *vis-à-vis* the broad spectrum of metaphysical questions that involve part-whole theorizing, is today subject to much controversy. Always in the background of the debate—and sometimes very much in the foreground—are questions such as the following:

1. Both Leśniewski's and Leonard and Goodman's original theories betray a nominalistic outlook, resulting in a conception of mereology as an ontologically parsimonious alternative to set theory. Today it is generally agreed that there is no essential link between mereology and nominalism. True, mereology—unlike set theory—is not committed to the existence of *abstracta*: the whole can be as concrete as the parts. But this does not mean that mereology carries any nominalistic commitments: for the parts can be as abstract as the whole (one may even consider applications of mereology to the set-theoretic universe). Still, to what extent does the formulation of classical mereology reflect, or suffer from, its original nominalistic biases? How much of it depends on the thought that we live in the austerity of a nominalistic universe?

2. Is classical mereology a *formal* theory—i.e., a theory of certain formal structures that are realized or exemplified across a wide range of domains, whatever the nature of the entities included therein—or is it a *substantive* piece of metaphysics? For instance, classical mereology involves decomposition principles to the effect that whenever something has a proper part, it has more than one—i.e., that there is always some *mereological difference* (a remainder) between a whole and its proper parts. Are such principles generally acceptable, or does their validity depend on the (sorts of) entities one considers? Conversely, classical mereology involves composition principles to the effect that whenever there are some things, there exists a whole that consists exactly of those things—i.e., that there is always a *mereological sum* (or fusion) of any number of parts (of whatever sort). Are these principles generally acceptable? If not, is there any systematic and illuminating way of determining which sums exist, and which do not?

3. Classical mereology is *extensional*: it says that sameness of proper parts is necessary and sufficient for sameness *tout court*. How do our views concerning identity and persistence bear on this principle? The *sufficiency* claim is often challenged on the grounds that some entities appear to differ exclusively with respect to the arrangement of their parts (two sentences made up of the same words), or by virtue of having different properties that do not manifest themselves in any mereological difference (the properties of a completed jigsaw puzzle vs. those of the “mere sum” of all its pieces). Conversely, it is often argued that the possibility of mereological change implies that sameness of parts is not *necessary* for identity: if Tibbles the cat survives the loss of its tail, then Tibbles *cum* tail (before the accident) and Tibbles *sine* tail (after the accident) are numerically the same in spite of their having different proper parts. Are such objections detrimental to classical mereology? Are they tenable at all?

4. Mathematically, classical mereology is isomorphic to a complete Boolean algebra with the zero element removed: there is no “null entity” which is part of everything (though there is a “universal entity” of which everything is part). Nominalistically this is perfectly reasonable: where and when would the “null entity” enjoy its existence? On the other hand, what reasons are there to retain this embargo in a less austere metaphysical theory? And what reasons are there to accept a universal entity, if its parts belong to different (perhaps, wildly different) ontological categories? Also, classical mereology is compatible with the existence of atoms, or “simples”—entities with no proper parts. Are there any such entities? And if there are, are any of them spatially extended? Is everything entirely made up of simples? Does everything comprise at least some simples, or is there room

for what is sometimes called “atomless gunk”—“gunk” any portion of which, no matter how small, can be further divided?

5. Even in relation to the nominalist’s favored realm, the realm of spatio-temporal particulars, there is room for fundamental metaphysical disagreement. Such entities have *spatial parts*, parts whose spatial location does not coincide with that of the whole. Your hands are spatial parts of your body in this sense, and from this window we can only see part of the parade, not all of it. Some entities have *temporal parts*, too, or so one may be inclined to say. The first inning is a temporal part of the whole baseball game in this sense: it occupies a shorter stretch of time, and much more will have to happen before the game—this particular game—is over. But do all entities have temporal parts? Do your hands and body extend over time in the same way in which they extend over space? Do *objects* have temporal parts in the same sense in which *events* do? Do *all* spatio-temporal entities consist of spatio-temporal parts?

These are just some examples, but they are indicative of the breadth and depth of the philosophical terrain that lies underneath any serious talk of parts and wholes. This issue of *The Journal of Philosophy* contains contributions devoted to an exploration of questions such as these from a variety of perspectives, in an effort to provide material toward an assessment of, and to raise new challenges for, what has become one of the central debates in contemporary metaphysics.

Woflgang Mann
Achille C. Varzi