Mereology and Galileo's reasoning

Rafał Gruszczyński*

Department of Logic
Nicolaus Copernicus University in Toruń
Poland
http://www.home.umk.pl/~gruszka
gruszka@umk.pl

The presentation has two intertwining objectives:

- application of mereology to produce a better description of the famous Galileo's reasoning about falling objects
- usage of the aforementioned reasoning to justify the axiom of existence of arbitrary finite mereological fusions.

The central and most important notion of mereology is that of *mereological fusion* (or *mereological sum*), defined by means of the solely primitive of mereology – the relational concept of *being part of*:

(†) x is a sum of the φ-ers $\longleftrightarrow_{\text{df}}$ every φ-er is part of x and every part of x has a part in common with some φ-er.

The notion has been widely studied ever since and two following axioms are most common:

$\star$ every group of φ-ers which consists of at least one object has its mereological sum
$\star\star$ every *finite* group of φ-ers which consists of at least one object has its mereological sum .

The first of these is usually used in purely mathematical applications of mereology, the second is sometimes treated as (controversial) ontological constraint: *any finite group of things may be composed into a whole* (see [7]). But can we really consider the moons of Jupiter and Galileo's heart to constitute any whole?

Galileo's on falling objects

Before Galileo it had been accepted — after Aristotle — that the acceleration of falling bodies is affected by their mass: the heavier the object, the greater its acceleration. So overwhelming had the Stagirite's authority been that for centuries the real nature of the phenomenon has eluded philosophers and Galileo's genius insight was needed to break the habit (see [1] for the reasoning, [2] for its analysis). In a nutshell, Galileo's great idea was to consider a pair of strapped bodies dropped from a certain height, to treat them as a single system, and to demonstrate that the Aristotle's principle applied to the system will result in contradiction.

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The gist of the presentation

The main idea of the presentation is that the model with strapped bodies my be replaced by the model with their mereological fusion. Thanks to this we may get better insight into the logical mechanisms hidden in the Italian thinker's reasoning (and obtain better understanding thereof). On the other hand, I will also argue that in order to accept Galileo's principle according to which acceleration of falling body is independent from its mass, ($\star\star$) is required. In consequence ($\star\star$) is probably much more innocent than it seems to be in light of the criticism administered therein.

The whole presentation may be viewed as a demonstration of application of mathematical ideas to explain earthly phenomena and reasonings leading to crucial discoveries in science.

References

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