Abstract

Prospects for an Integrated History and Philosophy of Composition
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I propose a new line of argument against metaphysical reductionism. Following John Dupré, Nancy Cartwright and others, my approach is based on a commitment to respect the best scientific practices and their outcomes while not renouncing philosophical judgment. I focus on the practices of decomposition in chemistry and physics, in order to questions the common assumption that everything can be smashed up into smaller and smaller units, down to elementary particles.

The practice of decomposing matter into its building blocks began in analytical chemistry centuries ago. But a careful look at the history of chemistry reveals that most of the useful analytical techniques did not involve simple decompositions. In the reactions in which molecules were somewhat cleanly dissociated into smaller units, those units most often turned out not to be atoms (as in the dissociation of H_2O into H^+ and OH^-, or into H_2 and O_2), since the stable units were often not atomic (e.g., H^+ and H_2, not H). In the early days of chemical analysis, there were also worries that the processes of alleged decomposition might be altering the substances being analyzed or even creating new ones.

Interestingly, these worries are reproduced and amplified when we consider the theoretical and experimental practices of modern nuclear and particle physics. "Atom-smashing" has never been Lego-like disassembly: when atomic nuclei are broken up, energy is almost always added or subtracted, and according to modern physics energy is a form of matter. Generally, experiments in high-energy physics paint a picture that does not support the naïve philosophical view of reductive levels (as stated by Paul Oppenheim and Hilary Putnam), according to which atoms are made up of elementary particles, which are unchangeable building-blocks. When two protons collide into each other in a particle accelerator, a whole host of other particles are created: should we say that a proton already contained these particles? And pair-creation and pair-annihilation should not lead us to conclude that a pair of photons consist of an electron and a positron, or vice versa. More generally, smashed-up pieces may not pre-exist in the whole. The ontology of virtual particles and vacuum fluctuations complicate the picture even further. Geoffrey Chew's "bootstrapping" view of elementary particles may be worth revisiting, after all.

In summary, attention to the actual practices of the physical sciences reveals that there has never been unequivocal scientific warrant for metaphysical reductionism as it is commonly conceived. If the source of metaphysical reductionism is not science, then what is it, and is it a trustworthy source? I will conclude with some methdological reflections concerning the prospects for bringing to the study of ontology the perspective and methods of integrated history and philosophy of science.