
Michael Heidelberger, Helmut Pulte, and Gregor Schiemann, eds. *Hermann von Helmholtz: Philosophische und Populärwissenschaftliche Schriften*. 3 vols. Hamburg: Meiner, 2017. Pp. lxiv+1391. €198.00 (cloth).

On the bookshelves of many, if not most, HOPOS scholars, one will find an edition of Hermann von Helmholtz's *Science and Culture: Popular and Philosophical Essays*, edited in 1995 by David Cahan (Chicago: University of Chicago Press). It includes in English translation a cross-section of essays on sense physiology and facts in perception, on Goethe and the natural sciences, on the axioms of geometry and the conservation of force, on thought in medicine, and on the origin of the planetary system. For Cahan, these are not only documents of nineteenth-century science, and they are not only of interest epistemologically to philosophers of science. He presents them as examples of science popularized in a specific cultural context.

The readers of Cahan's volume are now challenged to consider a more comprehensive edition that is also dedicated to Helmholtz's "philosophical and popular science writings." In addition to Cahan's 15 texts they will find another 51 in three volumes with altogether roughly three times the number of pages—all in German, except for the 5 texts that were originally published in English, including the extensive "Lectures on the Conservation of Energy." But aside from sheer quantity, what can be gained and what discoveries or insights lie in store for the readers of the new edition?

One hint is provided by the small difference in the title. The German editors—Michael Heidelberger, Helmut Pulte, and Gregor Schiemann—put the "philosophical" first and the "popular science" second. At the same time, they note in their introduction that Helmholtz was none too fond of the academic philosophy of his day and of the philosophical conceits of contemporary physicists like Karl Friedrich Zöllner (xli). Against this backdrop, Helmholtz popularized science not only to make science more accessible to a broader readership but to offer an alternative understanding of science. In an essay titled "Geschichte der Naturwissenschaften" (History of the natural sciences), he identifies a kind of pathology that begins with ancient philosophy and continues to his day: the notion that scientific knowledge requires strenuous, if not the straining of, thought (*angespanntes Denken*). On this notion, induction is far too simple, if not simple-minded, and therefore drops out of the picture altogether (1246). Helmholtz's popular scientific essays defy the notion that scientific thinking need be strenuous. Also, it aligns him with Davy, Faraday, Tyndall, and the tradition of the Royal Institution, where Helmholtz himself lectured on the con-

servation of energy and its wide-ranging significance. Accordingly, in an essay titled “Ueber das Streben nach Popularisirung der Wissenschaft” (On the ambition to popularize science), he defends Tyndall against Zöllner, details the difficulty of popularizing not the opinions but the thought process of science, and distinguishes the right way of popularizing science from misleading approaches. By showing how scientists use observation and experiment to subject apparently unruly and wildly accidental things to conceptual ordering, Helmholtz distinguishes astrology from astronomy, as well as metaphysics from philosophy (694).

This larger and practically comprehensive collection of Helmholtz’s own efforts to popularize science will include seemingly incidental texts that are not central to Helmholtz’s scientific and epistemological interests. It is all the more interesting and enjoyable to read Helmholtz’s essays on hurricanes and thunderstorms or on glaciers and ice. To the extent that science establishes the rule of law, it is the antagonist of chance. Could it be, he asks in these essays, that in the case of the weather we have to cede to the demon “chance,” which defends its territory against the claims of eternal laws (798)? He then proceeds to tell intuitive, vaguely mechanistic stories about, for example, the motion of ice as in a slow-moving river of snow. These accounts bring highly complex phenomena into the sphere of human understanding—with the help of some lines from a poem by Goethe but without the detail that, some years later, would be offered by his student Heinrich Hertz with respect to similar problems. In the confrontation with the demon that defies eternal law and the rule of reason, Helmholtz asserts the “civilizing power of science” that, following Cahan, is foregrounded also by the editors of the German volumes (xlx). Accordingly, they continue, the collection of these essays is not motivated by purely philological or antiquarian concerns but is to contribute to current discussions about the place of science in society or about epistemology and the philosophy of science (xlx). Unfortunately, they do not elaborate on this point and leave it to the reader to discover relevant points of contact. One of these, to be sure, might be Helmholtz’s critique of philosophy, which concerns more than the rehabilitation of Bacon and the tradition of inductive philosophy against apriorism and the deductive method. Helmholtz critiques the foundational aspirations of philosophy at a cultural moment when the progress of science transforms industry and technology. The meaning or significance of science should not be determined in reference to the history of ideas but comes with the “might of the new” (sobald das Neue eine Macht geworden ist; 692). However, if this insight motivates Helmholtz’s critique of philosophy and his popular writings, how far did he follow through with it?

Although the editors' motivation went beyond antiquarian concerns, it is finally worth noting their philological accomplishments. For each of the selections, they provide an elegant overview of its previous publications, and 80 pages of the final volume are dedicated to a bibliography of Helmholtz's works—publications, republications, and translations in German, English, and French. And as for those philosophical readers who are drawn primarily to the nexus of sense physiology and epistemology, a departure from the rule of including only self-contained essays proves most interesting: from the first and second editions of Helmholtz's *Handbook of Physiological Optics* the editors include both the original and the considerably revised versions of paragraph 26—indicating where and how he modified his epistemological reflections. For this alone, the three volumes prove a worthy complement and expansion of the canonical texts assembled by David Cahan in 1995.

Alfred Nordmann, *Technische Universität Darmstadt*

Andrea Gambarotto. *Vital Forces, Teleology, and Organization: Philosophy of Nature and the Rise of Biology in Germany*. Cham: Springer, 2018. Pp. xxii + 137. \$73.46 (cloth).

Andrea Gambarotto has produced an excellent monograph on the emergence of biology in Germany at the turn of the nineteenth century. His thesis is that “the problem of intrinsic teleology is bound to the philosophical enterprise of the *Naturphilosophen* and belongs to the historical conditions from which something like a ‘biology’ was able to emerge” (xx) and, hence, that “Romantic *Naturphilosophie* played an important role in the rise of biology in Germany” (xv). Life science in Germany arose “in firm opposition to, rather than continuity with, Kant” (26). That is, “the emergence of biology required a discursive break with Kant’s understanding of teleology as a regulative principle, so that teleology could be considered a constitutive character of living organisms” (xvii). “This shift from a regulative to a constitutive understanding of teleology was *the* most important factor enabling the emergence of biology at the beginning of the nineteenth century (at least in Germany)” (26). Concretely, “internal purposiveness defines the most peculiar phenomena of living beings: growth, reproduction, and functional integration” (22). “Teleology as self-regulation . . . played