

María de Paz and **Robert DiSalle**, eds. *Poincaré, Philosopher of Science: Problems and Perspectives*. The Western Ontario Series in Philosophy of Science, Vol. 79. Springer 2014. 191 pp. \$159.00 USD (Hardcover ISBN 9789401787796).

Poincaré's contributions to the science of his day continue to elicit philosophical interest and repay close study, well into to the 21st century. Particularly notable is the 'Poincaré Project' (2006–2009), headed by Augusto Franco de Oliveira, at the Center for the Philosophy of Science at the University of Lisbon, which has been a recent hub for several of these close studies of the French polymath. Although officially completed, this project has itself continued to be a font of research output, betokening María de Paz's 2014 dissertation, *Mecânica e Epistemologia em Henri Poincaré*, and co-occasioning the volume presently under review—her tribute, along with co-editor Robert DiSalle and thesis supervisor Isabel Serra, to the project.

The volume is a valuable but loose assortment of ten state-of-the-art papers by an international group of prominent scholars and philosophers of mathematics and physics. But fewer than half of them ever contemplate Poincaré's philosophy of science, and two of those are narrowly concerned with his conventionalism. Ironically, the effect is that *Poincaré, Philosopher of Science* is not wholly, or even primarily, concerned with enshrining Poincaré's status as a philosopher of science.

Instead, the chapters are divided into three parts: philosophy of science, foundations of mathematics, and foundations of physics. Perhaps for that reason, the editors' preface and introduction cautiously emphasize their volume's modest aims, one of which is to reflect 'the inseparability of mathematics, physics, and philosophy within Poincaré's thinking' (xii). Another stated aim is 'to provide a framework for future studies in the relationship between philosophy and science that are characteristic of Poincaré's corpus' (xiv). The volume does testify to Poincaré's enduring philosophical influence and the papers will be useful for future students of his works to take note of; but the sense in which the volume provides a 'framework' is vastly overstated (and in that regard, a more elaborate introduction would have been welcome). If the volume successfully achieves its stated aims, it is mostly just because Poincaré's work lent itself to them—not because of any overall cohesion among the individual chapters, nor because most address themselves to philosophical aspects of his work.

As edited collections go, the rationale for the volume is more apparent in several chapters, less so in most others. De Oliveira's paper, 'Poincaré and the principles of the calculus', quotes at length to display Poincaré's endorsement of Antoine Augustin Cournot's views on infinitesimals. João Príncipe's 'Henri Poincaré: the status of mechanical explanations and the foundations of statistical mechanics' tours the historical development of Poincaré's scientific interest in thermodynamics. Both chapters may be of interest to specialists working on those two topics, respectively; however, neither attempts to offer insight into how Poincaré's philosophical thinking related to these mathematical or scientific endeavors.

Although Poincaré was an important historical figure, the volume gives the appearance of being indifferent to purely historical matters. It is therefore perplexing that two or three of the book's ten chapters—their scholarly value notwithstanding—are squarely historical and without discernible philosophical consequence. Indeed, they appear to have warranted inclusion for no other reason than

that they were written by esteemed Poincaré scholars or are about Poincaré. This assessment is most gripping in Laurent Rollet's 'Portrait of Henri Poincaré as a young philosopher: the formative years (1860–1873)', which details Poincaré's early intellectual development and educational formation. It is a fascinating biographical account, containing fine descriptions about his family, and the political climate and the French education system within which Poincaré was educated. Rollet concludes that his philosophical portrait of Poincaré is inconclusive. But the extent to which it provides readers with insight into any of Poincaré's philosophical views does not, in fact, go beyond occasional use of the word 'philosophy'. Reinhard Kahle's 'Poincaré in Gottingen' scrutinizes an even narrower moment of the mathematician's life, focusing on Poincaré's trips to Gottingen and his interaction with David Hilbert during his 1909 lecture. Kahle reproduces their correspondence and puts Poincaré's lecture in historical context. Historians of mathematics will therefore find much of interest here, but the philosophical bearing of this chapter on Poincaré's philosophy of science is left unstated.

In that regard, Gerhard Heinzmann's ungainly titled, 'Does the French connection (Poincaré, Lautman) provide some insights facing the thesis that meta-mathematics is an exception to the slogan that mathematics concerns structures?' more deliberately engages the volume's stated aims. His contribution attempts to bring along the historical contexts of Poincaré contextualism and Albert Lautman's structuralism into a contemporary philosophical discussion of mathematical structuralism. Antonio Videira's 'Poincaré, indifferent hypotheses and metaphysics' argues that Poincaré's hesitancy to accept the role of indifferent hypothesis in scientific practice shaped his epistemology. Videira characterizes Poincaré as being skeptical of the physical content of scientific theories, consistent with his conventionalism, and he asserts that this skepticism was in conflict with Poincaré's realist position with respect to the structures that constitute physical theory. Videira also attempts to show that Poincaré's notion of indifferent hypotheses—free assumptions whose acceptance or rejection is compatible with empirical results—is thoroughly metaphysical. But while his paper is arguably the one that most directly attempts to relate Poincaré's views to philosophy of science, it unfortunately needed additional editing before publication to improve the prose and eradicate some self-refuting claims (e.g., 'every generalization is a hypothesis').

The remaining contributions—particularly those of Robert DiSalle, Janet Folina, María de Paz, and Isabel Serra—better address Poincaré's work in relation to more philosophical issues with science. For Poincaré, the choice of geometry to represent space was conventional, with simplicity—not empirical truth—being a primary factor in the determination of which geometry to deploy. Robert DiSalle's well-written and nuanced paper, 'Poincaré on the construction of space-time' illuminates Poincaré's epistemology of space. He examines the familiar critique, from Michael Friedman and others, that takes geometric conventionalism to be incompatible with implications of the theory of general relativity—a critique that Folina's effort attempts to blunt. In her 'Poincaré and the invention of convention', she argues that Poincaré invented a new category of truths that behave like other a priori truths, but are flexible enough, in the case of geometry, to be both sensitive to experience and evaluated by it. Emphasis on the role that experience plays in determining geometric conventions is an important point, to be sure, though one that is fairly explicitly made in Poincaré's introduction to *Science and Hypothesis*. For his part, DiSalle argues that Einstein's analysis of simultaneity successfully demonstrated that there are empirical factors that determine which geometry represents space, and that Poincaré's conventionalism in general and conception of space in particular, while inspirational to Einstein, prevented Poincaré from coming to grips with the Einstein-Minkowski conception of spacetime.

María de Paz's 'The third way epistemology: a recharacterization of Poincaré's conventionalism' provides a detailed synopsis of the construct of convention in Poincaré's philosophical works. Because geometric convention is so often mentioned in the Poincaré literature, a full taxonomy of the varied roles this construct plays is refreshing. For de Paz, many other interpreters have oversimplified the notion of convention. Not only has this led to an insufficient degree of nuance, it has led interpreters to claim that the construct of convention is inapplicable in cases where Poincaré never intended it to be applied. Therefore, de Paz takes up the task of defending and clarifying Poincaré's philosophical positions. By recognizing the different aspects and roles of convention, one can see how various species of convention have different applications in the philosophy of science.

Isabel Serra's contribution, 'Poincaré: a scientist inspired by his philosophy' attempts to describe the connections between his scientific work and philosophical thinking. It is original and arguably one of the papers that best attempts to engage the editors' aims. Serra traces out Poincaré's interest in Fuchsian functions and their relevance to differential equations and non-Euclidean geometry in order to ostensibly show how Poincaré's mathematical work brought him afield, into geometry, philosophy, optics, and electrodynamics. The paper succeeds in showing how Poincaré's philosophical and metascientific approach to research developed and contributed to his success as a scientist, as well as how this approach was a defining lifelong characteristic with multiple applications. Serra's paper may also appeal widely to philosophers, scientists, and historians.

Overall, *Poincaré, Philosopher of Science* does a nice job of exemplifying state-of-the-art Poincaré scholarship. But it is a slim volume of unscrupulous cost for its size, whose overall value—other than playing a tributary role to Lisbon's 'Poincaré Project'—reduces to the value of its individual chapters. Some of them will be very useful for future scholars.

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