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Classic Methodologies in the Philosophy of Science: Introduction to the Special Issue

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1 Introduction

Philosophy of sciences as we know it is a relatively recent creation, on which the analytic turn still casts its shadows. Its general characterization indeed is grounded on a philosophical method for analyzing the scientific enterprise whose origin rests on the view elaborated by the Vienna Circle and its legacy, taking as a point of departure 1922, when Moritz Schlick was appointed to the Chair of History and Philosophy of Inductive Sciences.

This perspective has been contested by many authors from Kuhn onwards, and has seen many 'turns' in the past forty years or so. From the historical turn (e.g. Kuhn and Lakatos), to the turn to practice (Hacking, Kitcher), through the social studies of science (e.g. Latour, Pickering), and historical epistemology (Daston, Rheinberger), to name a few. However, in many philosophical perspectives nowadays still prevails an emphasis on the methods of logical analysis as the only rigorous ones. This is part of the long shadow that the received view and the analytical perspective cast in philosophy of science today. Such a view implies a widespread devaluation of the role historically played by authors that, before the analytic turn and the foundation of the Vienna Circle, either as scientists or as philosophers, reflected differently on the method of scientific inquiry. In an attempt to recover its value, we call these approaches 'classic'.

The papers collected in this Special Issue focus especially on the period known as the 'long nineteenth century', that is, authors who worked between 1789 (the French Revolution) and 1918 (end of World War I). By engaging a variety of methods that scientists and philosophers from that period have offered, the contributors show that these "classic"

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approaches to the philosophy of science can supply us with alternative views on issues of current philosophical interest (e.g. on scientific realism; explanation; or causation) which are worth being revitalized and reintroduced into today's debate. Furthermore, this Issue embraces the general viewpoint of an integrated history and philosophy of science in maintaining that the historical perspective may aid and augment philosophical reflection. Thus, emphasis is given not only to the way philosophers tried to assess what is "scientific", but also—and quite importantly—to the way the scientific method inspired a variety of philosophical methodologies. The question the present Issue aims to deal with is in fact a broad one, involving the very relationship between philosophy and science and the possibility of casting new light on the philosophy of science itself.

In the following lines, we will succinctly present the contributing papers, in order to provide a general overview of the content of the present Issue.

Warren Schmaus's paper recovers the crucial concept of scientific revolution as proposed by two key figures in nineteenth-century French philosophy of sciences, namely Antoine-Augustine Cournot and Charles Renouvier. The concept of scientific revolution is popular in contemporary philosophy of science since the work of Kuhn. However, historical approaches to philosophy of science have shown its roots in the work of eighteenth-century figures such as D'Alembert or even Kant. Consistently with this historical approach, instead of viewing Cournot or Renouvier as forerunners of Kuhn's perspective, Schmaus presents their notion of scientific revolution as a reflection on Comte's and Whewell's philosophical conceptions and as a critical assessment of the developments of mathematics and the sciences in preceding periods. Schmaus also compares Cournot's and Renouvier's views with Kuhn's, in order to show the value and relevance of their work in the light of contemporary issues. With his study, Schmaus allows us to appreciate the sophisticated analysis of science provided by authors that were in deep contact with the sciences of their time and well acquainted with the history of sciences, in particular with the astronomical revolution.

Ragnar Van der Merwe focuses on a key feature of William Whewell's philosophy of science in order to contribute to a contemporary debated issue. That feature is Whewell's appeal to Aristotle's form/matter hylomorphism as a metaphor to explain how mind and world interface and merge in successful scientific inquiry. For Van der Merwe, insofar as Whewell's metaphor suggests a middle way between rationalism and empiricism, it provides a robust explanatory tool for those who hold that mind and world are inextricably integrated or entwined, that is, that there is no strict epistemology vs. ontology divide. This view is defended by "experience pragmatists" such as Steven Levine, for example, according to whom the world is not given, but rather experienced. Defending such a conception is problematic—observes Van der Merwe—and in fact Levine's explanation isn't satisfactory enough. But Whewell's hylomorphism may help in this regard, providing Levine's account the extra explanatory power it requires. Van der Merwe thus explores thoroughly Whewell's attempts to merge internalism (anti-realism) and externalism (realism) in his description of experience, and stresses Whewell's idea that scientific inquiry is the method that most successfully allows mind and world to align. Perhaps this will not exhaust the ongoing debate, but Whewell might at least provide a valuable explanatory tool to experience pragmatists, for his view seems to satisfy both our intuition that mind and world are distinct and the evident truism that there is no God's eye view from which to analyze their separation.

In her paper, **Francesca Biagioli** explores Hermann von Helmholtz's conception of measurement and argues that it differs from later representational conceptions due to Helmholtz's adherence to a classic approach to measurement. That approach implies, in particular, that the arithmetic laws of addition define what is measurable as a particular domain for their application, and, at the same time, the extensibility of these laws to all known physical processes works as a heuristic principle for empirical research. Biagioli's focus on such an approach allows her (1) to lend plausibility to some of the controversial aspects of Helmholtz's theory, and (2) to provide a philosophical perspective on quantification problems that originated in the nineteenth century. Furthermore, she pays special attention to Helmholtz's engagement with the quantification problem of psychophysics. As Biagioli observes, Helmholtz's interest in the work of Gustav Fechner has been crucial for the development of the philosophical assumptions lying at the heart of his 1887 paper "Counting and Measuring from an Epistemological Point of View", which is a turning point in the prehistory of contemporary measurement theory.

The three following papers engage differently with Ernst Mach (among other authors). **John Preston** explores the idea of a "pseudo-problem" (*Scheinproblem* and *Pseudoproblem*) that Mach seems to have introduced in the epistemological debate. Preston focuses on how Mach identified and treated pseudo-problems, comparing his approach with that of two other philosopher-scientists of the same period, Heinrich Hertz and Ludwig Boltzmann, who gave different diagnoses of such problems and suggested quite different treatments for them. In Mach it is especially evident that pseudo-problems arise not just from "philosophical thinking" but from conceptual and methodological conflicts between different approaches to certain fundamental concepts (such as "body" and "self"), approaches that must be substituted for another entirely different way of thinking, one that does not even allow them to arise. As Preston aptly shows, both Hertz and Boltzmann treat the question differently, but there still seems to be a continuity between the way pseudo-problems are conceived by these authors. In fact, pseudo-problems or pseudo-questions indicate that a conceptual problem is in the offing, and that a clarification is needed in the very way we pose questions. It is a methodological issue, actually. An issue that involves how we engage with scientific inquiry and its concepts. Interestingly, we can appreciate that these early reflections on pseudo-problems are independent of a "linguistic turn" and separated from an analytic attitude towards philosophy. Among the three authors explored by Preston, only Boltzmann prefigures those developments by locating these problems in language (specifically in semantics), but then he gives a naturalistic explanation of why these problems inevitably arise, thus maintaining a fundamental distance from the subsequent logical positivist stage.

Luca Guzzardi provides a thorough study on Ernst Mach's experimental work with "spark waves" and other types of shock waves, which brought Mach to the 1887-1888 famous schlieren photographs of supersonic phenomena triggered by bullets shot at high speed. Guzzardi attempts especially to show that it was Mach's inclination towards experimental research that may have had crucially contributed to the development of his epistemological and ontological views, and not the contrary, as has been often argued in the scholarly literature. Guzzardi's view is coherent with Mach's reiterated remark that he is a scientist and not a philosopher; thus, it makes much more sense to focus on his activity as an experimental physicist as the background of his epistemological concerns, instead of contextualizing that activity within his phenomenalist philosophy. In fact, as Guzzardi aptly argues, Mach's early experimental work was largely independent from any kind of ontological commitment, and it is only at a later stage—on the basis of the collected results—that

Mach elaborates some epistemological considerations. The roots of these considerations lie in Mach's work as a physicist, as Guzzardi's investigation on Mach's experiments on shock waves convincingly shows.

With his paper, **Pietro Gori** pursues a twofold aim. Firstly, he focuses on the principles of Mach's historico-critical approach to scientific knowledge, that Gori interprets as an attempt to elaborate Kant's philosophical methodology in a new way and to make use of it to rid scientific inquiries of metaphysical obscurities. This study allows Gori, on the one hand, to provide further considerations, in addition to those examined in the existing literature, with which to assess the originality of Mach's methodological attitude toward scientific knowledge; on the other hand, to explore the basic tenets of Mach's epistemology, focusing especially on his interest in the value and meaning of scientific knowledge. The second aim of the paper is to defend that Mach's assessment of scientific concepts, theories, and laws, and his observations on the relationship between theories and facts may still constitute a relevant contribution to the debate on scientific realism. In fact, Gori argues that there is more than one feature of Mach's epistemological view that may be consistent with the way perspectival truth has been assessed in recent discussions, especially if one considers Mach's focus on the situatedness of scientific knowledge, both within its historical and cultural context and within the individual viewpoint determined by the interests of any researcher working in a well-defined field (e.g. physics vs. psychology).

In the last three papers, the notion of structure plays a key role in order to shed light on relevant philosophical positions about the sciences developed in the classical period. With their contributions focused (variously) on that issue, José Ferreirós, Janet Folina, and María de Paz aim to provide us with interesting approaches to current topics. **José Ferreirós** presents a conceptual version of structuralism as a philosophical position connecting with the conceptual work in mathematics done by Riemann, Dedekind, Hilbert and Noether. The emphasis on relations is characteristic of their time, and their role as well as their interpretation is still currently debated in the philosophy of mathematics. This conceptualist approach, which is in line with the work of Feferman and Parsons, aims to capture the classical views of these scientists properly and attempts to resolve the tension with platonistic structuralist approaches. A further important contribution of the paper rests in the notion of objectivity elaborated by Ferreirós as a development of some of the classical views of the mathematicians mentioned above, as well as of the philosophical perspectives of Peirce and Cassirer. That notion stresses the role played by agents and communities in the production of mathematical knowledge, but it also allows to engage with a minimal realism regarding logical objects which separates mathematical ontology from social or fictional ontology.

Janet Folina's paper approaches the notion of structure as a unifying concept in Henri Poincaré's philosophy of mathematics and science. With the use of this concept, Folina stresses the holistic perspective and interdisciplinary character of Poincaré's philosophical position. Structure connects the different areas of inquiry in which the French polymath worked and helps to understand and explain Poincaré's success as a scientist. As structure does not always explicitly appear in Poincaré's writings, Folina makes use of the idea of family resemblance in order to develop her views. For her, unifying concepts are heuristic tools which connect concepts in different areas; new connections frequently provide new insights in science and mathematics, which can lead to the development of new scientific ideas. Thus, understanding the use of unifying concepts can give us fresh ideas to grasp the progress of science.

María de Paz offers an interpretation of Henri Poincaré's conventionalism as emerged from his use of two specific scientific methodologies: structuralism and hypothetical-deductivism. The paper analyzes how the use of these methods led Poincaré to the introduction of the notion of convention, a new epistemological category that aims to account for a modern view of science. Conventions imply that there are assertions in science that are not simply true or false, showing that scientists do not always employ completely proved statements in their work. The paper connects the use of these methods in Poincaré's work in geometry and physics but also acknowledges the specific philosophical approaches to these sciences. Conventions have played an important role in the logical analysis of science and by understanding the methods underlying their introduction, their logical as well as their epistemological status can be clarified. Also, the presentation of a dynamic view of science in which the status of fundamental principles can be open to revision is worth considering in the context of current philosophy of science.

As a conclusive remark, we might say that all the papers collected in this Special Issue engage with sophisticated classic philosophical positions through methodologies different than logical analysis of scientific language. The Special Issue also aims to leave aside traditional dichotomies between philosophy of science as dealing with the logic of science and history or sociology of science as dealing with peripheral questions. The classical approaches here collected explore a variety of different perspectives, considering historical factors in their analysis of science as well as logical ones, and also stressing the role of the agents and the scientific community. By no means are the perspectives about 'classic methodologies' exhausted by the work presented in this Issue. Several other topics and figures can fall under the label 'classic' in the way we are using it here. Our primary aim in working on these topics has been to promote a reconsideration of some classical positions as linked to relevant topics in philosophy of science, with the hope that this may be a stimulus for further works defending the same approach. It is our belief that, because of their richness, these perspectives may be a fruitful contribution to current debates in the philosophy of science, and that they may help us rethink old problems in a new light.

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