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Gustavo Cevolani & Roberto Festa

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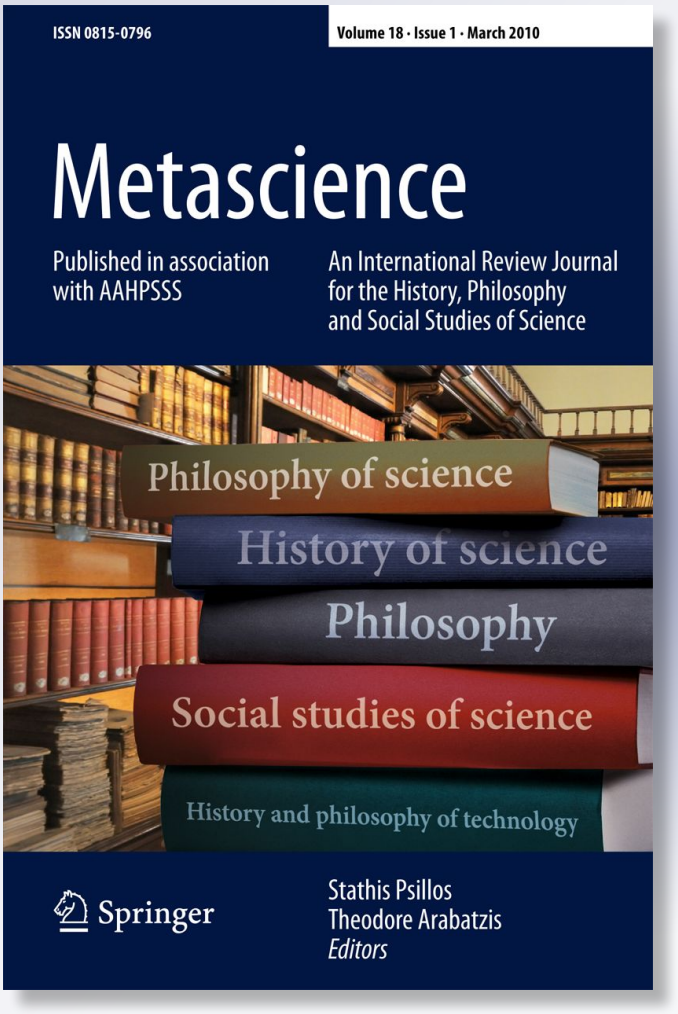

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BOOK REVIEW

"Merely a logician's toy?" Belief revision confronting scientific theory change

Erik J. Olsson and Sebastian Enqvist (eds): Belief revision meets philosophy of science. Berlin: Springer, 2011, xx+359pp, €145.55 HB

Gustavo Cevolani · Roberto Festa

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Over the past 50 years, theory change has been a central issue in the philosophy of science. While in the 1960s and 1970s it was investigated mainly within the historicist approaches worked out by Thomas Kuhn, Paul Feyerabend, Imre Lakatos and many others, starting from the end of the 1970s it has attracted the attention of an increasing number of philosophers with a logical and formal background. The conference devoted to *The Logic and Epistemology of Scientific Change* held in Helsinki in 1977 (cf. Niiniluoto and Tuomela 1979) can be considered as the starting point of this logical turn in the research on theory change. Within that conference, some new formal approaches were presented, including the structuralist view of scientific theories, the post-Popperian approaches to verisimilitude and (the logics of) belief revision. In the following decade, Carlos E. Alchourrón, Peter Gärdenfors and David Makinson developed their version of belief revision, commonly known as AGM. The central question of AGM and, more generally, of belief revision can be stated as follows: How should we revise our theory, or set of beliefs, in response to new evidence in the case where such evidence is logically incompatible with our theory?

Although an important source of inspiration of the early versions of AGM was the analysis of some central themes of epistemology and philosophy of

G. Cevolani (✉)
Department of Philosophy, University of Bologna, via Zamboni 38,
40126 Bologna, Italy
e-mail: g.cevolani@gmail.com

R. Festa
Department of Philosophy, Languages, and Literatures, University of Trieste,
Androna Campo Marzio 10, 34123 Trieste, Italy
e-mail: festa@units.it

Present Address:
G. Cevolani
Piazza Sassatelli 26, 41057 Spilamberto, MO, Italy

science—such as counterfactual conditionals, explanation and causality (cf. Gärdenfors 1988, 2011)—very soon the main focus of AGM theorists switched to different problems, such as the refinement of the logical apparatus of AGM itself and its application to Artificial Intelligence (cf. Hansson 1999; Fermé and Hansson 2011). Therefore, it is easy to predict that scholars with a formal and logical stance toward epistemology and philosophy of science will warmly welcome *Belief Revision Meets Philosophy of Science*, a collection of fifteen papers edited by Erik J. Olsson and Sebastian Enqvist. Indeed, the contributors to this volume share the goal to bring AGM back to some of its original motivations, by showing, as Hans Rott puts it, that AGM is not only "a logician's plaything" (73) and can be fruitfully applied (also) in philosophy of science.

A detailed historical account of the development of AGM and its spread in the AI community is provided in the first chapter, by Raúl Carnota and Ricardo Rodríguez. The remaining chapters can be roughly divided into three groups. The papers in the first group concern the application of AGM to the analysis of some important issues in the philosophy of science, such as the dynamics of empirical theories (Sven O. Hansson), the rational reconstruction of some aspects of Lakatos's methodology (Hans Rott), the role of abduction in scientific belief revision (Gerhard Schurz), the "conceptual closure" of mature theories (Bengt Hansson) and the rationality of methodological change (Jonas Nilsson and Sten Lindström). The papers in the second group explore the relations between AGM and other accounts of theory change, including the structuralist view of scientific theories (Sebastian Enqvist), Gärdenfors's theory of conceptual spaces (Peter Gärdenfors and Frank Zenker), Levi's account of belief change (Isaac Levi), epistemic logics (Caroline Semmling and Heinrich Wansing) and Thagard's theory of explanatory coherence (Paul Thagard). Finally, the papers in the third group present some extensions or modifications of AGM intended to provide more realistic models of belief change, like "norm-inclusive belief revision" (Horacio Arló-Costa and Arthur Pedersen), belief change for scientific communities and other collective agents (David Westlund), the integration of Hintikka's interrogative model of inquiry within AGM (Emmanuel Genot) and the analysis of the contrast between functional and relational approaches to belief change (Erik J. Olsson).

Most contributors would seem to agree with Sven O. Hansson that "[t]he standard [AGM] framework […] is not suitable for analyzing the mechanisms of change in science" (43), and needs important modifications. To mention just one central problem, addressed by Schurz, AGM lacks "learning ability" (80) in the sense that when a new, possibly surprising, information is acquired, it is simply accommodated within the scientists' set of beliefs, under the only constraint of maintaining consistency. However, what actually happens in science seems to be very different. When a black swan is observed, the scientific corpus is not simply updated by removing the hypothesis that all swans are white, but scientists also try to figure out an alternative hypothesis explaining the evidence. Accordingly, Schurz, Sven O. Hansson and (in passing) other contributors discuss the possibility of developing abductive, or explanatory, belief change, incorporating some kind of inference to the best explanation.

A more general kind of inadequacy of AGM is that its standard versions do not include any well-defined scientific axiology. As noted by Nilsson and Lindström, most methodological approaches are inspired by an instrumental view of scientific rationality—according to which methodological rules should be evaluated with respect to their efficiency in achieving the assumed cognitive goals of science, such as "truth, true explanatory theories, maximizing predictive power, high verisimilitude, empirical adequacy or problem-solving ability" (348). Since it is not clear which are, if any, the cognitive goals assumed to be central for scientific research by AGM theorists, the efficiency of the AGM rules for theory change in achieving these goals can be hardly evaluated. To be sure, AGM theorists often justify their rules on the basis of a general methodological principle, known as the *principle of minimal change*, which can be stated as follows: "When you stop believing in something you should keep as many other beliefs as possible, and when you start believing in something you should not start to believe more than necessary" (Westlund, 213). However, this principle "has often been advocated […] but rarely defended" (Thagard, 341), and its actual importance for AGM has been strongly challenged (Rott 2000).

It seems to us that much work has still to be done in order to show that AGM or other theories of belief revision can be fruitfully applied outside the "aseptic" realms of logic and database updating. *Belief Revision Meets Philosophy of Science* is an outstanding contribution to this endeavor, which has the merit to set up a rich agenda of important problems to be addressed by future research. A natural addition to this agenda, which has recently attracted the attention of some scholars but is only touched on in the book, concerns the efficiency of AGM rules for theory change in tracking truth and verisimilitude conceived as central cognitive goals of inquiry. As Rott emphasizes, within AGM "it is difficult to have *truth as the goal of inquiry*" (60, note 2), since it can be proved that "there is no belief-contravening revision by some (true) sentence that strictly increases the set of […] truths [in a theory], even if the sentence is true and the revision leads from a false to a true theory" (*ibid*; see also Rott 2000, pp. 518–521). One can then ask whether and to what extent AGM rules for theory change effectively track truth approximation, i.e., under what conditions belief revision leads to theories that are closer to the truth than the preceding ones—an issue originally raised by Niiniluoto (1999). This problem has been recently addressed in a symposium on *Belief Revision Aiming at Truth Approximation*, organized during the second EPSA conference in Amsterdam (2009) with the purpose of exploring the relationships and possible interactions between AGM and the post-Popperian theories of verisimilitude. For a happy editorial coincidence, some of the papers presented at the conference will shortly appear in a special issue of *Erkenntnis* (September 2011), edited by Theo Kuipers and Gerhard Schurz. The present book and the *Erkenntnis* issue together offer a rich and up-do-date inventory of contributions, which cover almost all the issues on the border between AGM and philosophy of science, laying the bases for a further, fruitful exploration of this exciting field of research.

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