Review of Léna Soler, Emiliano Trizio, and Andrew Pickering, eds. *Science as It Could Have Been. Discussing the Contingency/Inevitability Problem.* Pittsburgh: Pittsburgh University Press, 2016.

 [This is a preprint version. The final version of this review appears in *HOPOS. Journal of the International Society for the History of Philosophy of Science*]

Are the contents of scientific theories tied to their histories? Could the development of science have taken a different course? Can we imagine successful science doing without our most cherished ideas and theories? Recent years have seen a growing interest in the question as to whether and to what extent scientific knowledge is shaped by contingent factors. *Science as it could have been* is the first essay collection to explicitly approach the issue from a philosophical angle. The volume aims to provide an overview of the current state of the debate, to clarify the main concepts involved, and to make progress regarding the central philosophical questions that arise with respect to the problem of contingency and inevitability in science.

The book is organized in six parts. The first part offers conceptual clarifications of, and reflections on, the structure of the conflict between “contingentist” and “inevitabilist” interpretations of science (contributions by Léna Soler, Catherine Allamel-Raffin and Jean-Luc Gangloff). Three articles that investigate how the contingency issue relates to questions of ontology, and to various forms of realism, make up the second part of the book (Andrew Pickering, Emiliano Trizio and Mieke Boon). The third part comprises contributions that seek to make the contingency issue empirically tractable by focusing on concrete and local historical cases (Harry Collins, Ronald Giere, Yves Gingras). Whether there is room for contingency in mathematics is explored in the fourth part of the volume (Jean Paul Van Bendegem, Jean-Michel Salanskis, Ian Hacking), while the fifth part widens the scope of the discussion to include also disciplines like psychology and the material-practical dimensions of science (Michel Bitbol and Claire Petitmengin, Joseph Rouse). And finally, the sixth part explores the relations between contingency and pluralism in science (Jean Marc Lévy-Leblond, Hasok Chang).

Although the contributions come from a variety of different philosophical backgrounds, they share a common concern for clarifying the relevant concepts. They grapple not only with the question of whether science is contingent, but also with what exactly it means to say that it is. The difficulty of delineating the positions at stake and of finding a clear language is present throughout the book. This sometimes makes for a repetitive read, as different authors continue to return to the same definitions. But one also finds novel attempts at expressing the crucial ideas.

For instance, Soler stages a dialogical confrontation between the “contingentist” and the “inevitabilist” over the “put up or shut up argument” – a challenge that asks the “contingentist” to “put up” by pointing to alternatives to accepted scientific achievements (Chapter 1). In the course of discussing various “contingentist” answers to the challenge, as well as “inevitabilist” rejoinders, Soler is led to refine her definitions of “contingentism” and “inevitabilism” so as to include the long-term dimension of scientific development: since the inevitabilist can always discredit alternative theories as only transiently acceptable, the conflict will ultimately come to focus on the long run. Other contributions reach very different definitions. In direct conflict with Soler’s approach, Collins reduces “contingentism” to the empirical thesis that scientific communities do sometimes entertain incompatible theories over short periods of time (Chapter 6). Yet another option is presented by Giere, who understands contingency and inevitability in terms of a causal analysis of the determining factors of scientific discoveries (Chapter 7). According to Giere, contingency typically occurs in the early stages of a discovery process, when the different causal paths that eventually converge in the scientific discovery have not yet met, thus still leaving room for the interference of various accidental factors. Here, contingency is linked to a historical-causal perspective. But contingency can also be defined in epistemic terms more narrowly (Boon, Chapter 5), it can be seen to be rooted on the level of ontology (Pickering, Chapter 3), or it can be transformed from a descriptive into a normative issue (Chang, Chapter 15).

As this brief overview indicates, the different solutions to the problem of how to define contingency and inevitability in science do not always speak to each other. But this need not be a bad thing. The variety of approaches assembled in *Science as it could have been* attests to the fact that the problem of contingency affects many different philosophical debates and traditions. Here are four well-known fields of discussion that are particularly prominent in the collection:

First, contingency has always loomed in the background of discussions of scientific realism. A systematic analysis of the relations between contingency and scientific realism is provided by Emiliano Trizio (Chapter 4). Trizio argues that “inevitabilism” is compatible with both realist and anti-realist commitments, while “contingentism” challenges the “selective realist” strategy of identifying the historically invariant success-generating components of scientific theories. The sentiment that contingency and scientific realism are incompatible can also be found in the contributions by Boon (Chapter 5) and Allamel-Raffin and Gangloff (Chapter 2), while Giere seeks to make a moderate contingency claim compatible with what he calls “conditional realism” (Chapter 7).

Second, contingency is central to discussions of instruments and scientific practices. While Rouse suspects that debating contingency in science might be a way of reasserting the philosophical primacy of theories and representations over practices (Chapter 13), other authors argue that the question of contingency was at the heart of the “practice turn” all along. Soler and Trizio both note that a specific version of the contingency problem arises when science is understood as a practice of creating “robust fits” – that is temporarily stable arrangements of instruments, skills, data and interpretations. Based on a similar conception, Boon pushes to leave representationalist views of science behind. She sketches an “epistemological constructivism” of “interfaces” and “nomological machines” that attempts to capture both the contingent and the inevitable aspects of experimental knowledge (Chapter 5).

Third, there are natural connections between the contingency issue and scientific pluralism. Soler argues that the monist regime of science stacks the cards in favour of the inevitabilist and that therefore only a pluralist scientific culture would provide the neutral grounds to decide empirically between “contingentism” and “inevitabilism” (Chapter 1). Chang goes one step further and pushes a normative argument in favour of scientific pluralism and contingency. According to his view, a pluralism set on cultivating contingencies, rather than eliminating them, would be more beneficial to the aims of the scientific enterprise than our current monism is (Chapter 15).

And fourth, discussions of contingency frequently lead to questions of theory-identity. Lévy-Leblond’s argument for contingency in physics makes central use of the idea that theories that share the same formal structure can nevertheless have very different intellectual contents, thus constituting genuine alternatives (Chapter 14). Van Bendegem observes that “contingentists” and “inevitabilists” will disagree about whether alternative interpretations of mathematical concepts still count as “genuine” mathematics (Chapter 9). And Hacking claims that the boundaries of what counts as mathematics are themselves historically contingent (Chapter 11). These contributions reveal that the question of when two theories are different, and when theories that are recognizably different should count as “scientific”, is central to the decision between “contingentist” and “inevitabilist” views.

Other philosophical debates that are touched upon in the volume are social constructivism, theory-choice, counterfactual history, underdetermination and scientific progress. Contingency is central to all of them. The sometimes confusing plurality of approaches and voices found in the book is thus perhaps simply a symptom of the pervasiveness of the topic.

It has to be noted that the papers assembled in the book are not all of the same high quality. Some remain somewhat sketchy and programmatic, and one hopes that the authors will follow through with more detailed analyses in future work. But viewed as a compilation with an agenda that goes beyond the individual contributions, *Science as it could have been* has set itself very high goals. It seeks to give space to the plurality of approaches and interests in contemporary philosophy of science, without losing sight of the common thread that connects various views on the issue of contingency. It attempts to develop conceptual tools that are sufficiently general to further the common conversation, while at the same time engaging on a detailed level with specific arguments and case studies. It aims to show what more traditional, or at least better known, philosophical positions imply for the question of contingency in science, while simultaneously suggesting that the focus on contingency may transform the philosophical landscape significantly. *Science as it could have been* does not fully meet these goals, but at the very least, it succeeds atproviding a multifaceted overview over the current state of the debate on contingency in science.

I want to close with a general observation about the status of the issue in current history and philosophy of science. Throughout the volume, one runs across the complaint that in philosophy of science “inevitabilism” constitutes the default position. Soler speaks of “inevitabilist instincts” that have to be dislodged if there is to be a balanced discussion on the topic. Pickering claims that an ontological vision of the world as a fixed structure creates strong “inevitabilist” intuitions. And Van Bendegem notes that discussions about mathematics are dominated by assumptions of uniqueness and inevitability. The picture is one of an unbalanced conflict, in which the inevitability of scientific achievements is often taken for granted uncritically.

It may be true that many philosophers of science have deep-seated “inevitabilist” inclinations, especially when it comes to mathematics. But even if this is the case, these inclinations are not represented in the volume. Of the fifteen contributions assembled in the book, not a single one defends a strong inevitabilist position. The few authors that are critical of “contingentism” also voice scepticism about “inevitabilism”, suggesting that neither option is defensible. But the bulk of contributions argues either in favour of versions of “contingentism”, or for compatibilist positions that have both contingent and inevitable dimensions.

So despite voicing a diagnosis that if true would be unfavourable to the “contingentist”, *Science as it could have been* may actually give the “contingentist” reasons to be optimistic. It indicates that in the last decades, philosophers of science have become much more willing to accept that contingency may play at least some role in the development, acceptance, and preservation of scientific achievements.