

A Paean to Contingency

Léna Soler, Emiliano Trizio, and Andrew Pickering (eds): *Science as it Could Have Been: Discussing the Contingency/Inevitability Problem*. Pittsburgh: University of Pittsburg Press, 2015, x+462 pp., \$61.95 HB.

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The contingency/inevitability (C/I) problem consists in questions about the extent to which science contingent or inevitable, what parts of it are contingent or inevitable, and whether alternative scientific trajectories might be just as successful as the one we have. It is relatively new as a well-delineated object of philosophical inquiry, dating to Ian Hacking's observation in *The Social Construction of What?* (1999) that the social construction movement raises questions about contingency and inevitability that can be understood as distinct from, and perhaps more promising than, longstanding debates about scientific realism and anti-realism. In the years since Hacking defined the key terms of the C/I problem, a group of scholars has coalesced around the questions he posed. Those questions motivated, for example, a 2009 workshop at the Fondation Des Treilles in Tourtour, France, and this book synthesizes its results.

A volume seeking to define an issue of such recent vintage faces numerous challenges, not least of which is justifying its subject's philosophical worth. This task falls within the remit of Léna Soler's introduction. Soler locates the C/I problem subsequent to what she calls the "turn to practice" (2). This methodological tradition within science studies, beginning in the 1970s and picking up steam through the later twentieth century, rejected a narrow focus on the logical structure of theories and instead maintained that understanding the scientific enterprise requires engaging with the details of community structures, experimental techniques, pedagogical traditions, and other contextually situated practices. Works in this tradition often focus on local case studies, but they share the conviction that our "inevabilist instinct" (21)—the common and persistent sense that the trajectory of science is in some way inured to the contingencies of its context—is mistaken. The C/I problem, Soler contends, offers a systematic way to interrogate this instinct and in so doing to develop philosophical accounts of the scientific project that bring some of our deepest and least-examined assumptions about it to the fore.

The fifteen contributions Soler introduces aim to illustrate how this is so. They are sorted into six sections, each of which confronts a different aspect of the C/I problem. Part 1 tackles some general issues with delineating the problem. Soler also contributes the first essay, which attacks an argument that threatens to clip the C/I problem's wings before it takes flight: the "put-up-or-shut-demand," the charge that unless those claiming that the results of successful science are contingent can produce actually existing alternatives, then the argument for contingency is moot. Rather than undermining contingentism, however, this charge, on Soler's account, exposes the deep commitment to monism that pervades modern science. Through the socialization of its practitioners, the functioning of its institutions, and the policing of its ranks, science actively shuts down any alternatives to the prevailing consensus. The burden of proof falls on the inevitabilist to defend monism, Soler argues, before any empirical demands can be leveled at the contingentist.

The other contribution in part 1, by Catherine Allamel-Raffin and Jean-Luc Gangloff, seeks to define contingentism and inevitabilism. They note that considerable ambiguity remains in

several aspects of the issue. It is not clear if contingency and inevitability are all-or-nothing propositions, or if intermediate, compatibilist positions are viable. The problem has been elaborated principally through examples from physics at the expense of biology, chemistry, psychology, and other sciences, and this might skew the conversation in ways that are not clear until studies of additional sciences are available. When we talk of inevitability, we might mean logical inevitability or we might mean practical (historical, sociological) inevitability. In order to ground claims that an alternative science could equal the success of the science we have, we will need rigorous criteria for success. Despite these ambiguities, Allamel-Raffin and Gangloff conclude that “the notions of contingentism/inevitabilism seem to be the most promising heuristic device of the past decade for a better understanding of what science actually is” (113). They follow Soler in suggesting that these are exactly the types of questions we need to be asking, and which have not been adequately addressed in the context of other philosophical problems.

Part 2 turns to perhaps the most troubling question about the C/I problem: how is it different from the realism/anti-realism debate? The three essays here give somewhat different pictures. Andrew Pickering’s essay reprises his argument from *The Mangle of Practice* (1995), pointing to the deep ontological commitments we accept if we succumb to the inevitabilist instinct and suggesting that it closes our eyes to the various types of agency at play in creating scientific knowledge. On this account, contingentism appears as a tool deployed in the service of a conversation still defined by realism/anti-realism. Emiliano Trizio aims to put some distance between the two issues. It is possible, he suggests, to be both an anti-realist and an inevitabilist—we might argue that the internal logic of science compels certain theoretical shifts, without presuming that those shifts result in truer knowledge of the world. Trizio, however, denies that a contingentist can also be a realist, given his understanding of (meaningful) contingency as making deep claims about the metaphysical underpinnings of science. Mieke Boon, in contrast to both Pickering and Trizio, attempts to conceptualize the C/I problem in a way that moves past the realism/anti-realism debate. She observes that contingency and inevitability can coexist, and might intermingle in different ways, depending on what aspects of science they hold to be contingent or inevitable.

It is evident from part 2 that the realism/anti-realism axis still wields considerable influence over how philosophers think about contingency and inevitability. It also, however, suggests how the two problems can be disentangled. Pickering and Trizio both identify the contingency of *ontological claims* as the most meaningful and interesting form of contingency. But Boon shows, as have others (Kinzel 2015; Martin 2013), that contingency claims can also be meaningful when applied to other targets. If we think of contingency claims as applicable not just to scientists’ claims about the entities, processes, and/or structures that exist in the world, but also to their instruments, interpretations, practices, and values, then we see more clearly how the C/I problem is distinct from the realism/anti-realism debate. When applied to different targets, contingency and inevitability can comfortably coexist in a way that realism and anti-realism cannot.

The remainder of the volume cleaves mostly to an expansive view of contingency and inevitability in line with Boon’s interpretation. Part 3 includes three essays on ways to empirically frame contingency claims. With the exception of Harry Collins, whose contribution seeks to make the contingency question tractable by looking at the way alternatives present themselves in the short term, these authors turn to history. Ronald N. Giere advocates for an evolutionary understanding of scientific development. In abstract terms, it is difficult or impossible to say whether the large sweep of evolution is contingent or inevitable, but we can provide fairly robust

local accounts based on our historical knowledge of the relevant constraints at specific times and places. Yves Gingras turns to the case study of electron diffraction to show that a variety of contingent factors—order of discovery, accident, individual predilections, and other idiosyncrasies of human history—work together to produce historical sequences that might be more or less robust, depending on how these factors work together.

The question of we can empirically arbitrate contingency claims highlights a particularly notable feature of the C/I problem: the deep connection it implies between history and philosophy of science. Historians are sometimes apt to malign philosophy as a field prone to shoehorning complicated historical narratives into preconceived and overly abstract frameworks. Philosophers, for their part, sometimes consider historians so mired in local detail that they close their eyes to even the possibility of generalizable conclusions. These are caricatures, but they reflect features recent history of these disciplines that shape their interactions and point out the real—and regrettable—distance between them. The C/I problem offers the possibility of transcending this divide. Arbitrating contingency claims requires engaging with a type of history that historians will recognize, and philosophical examinations of the role of contingency in science have widespread implications for historical methodology, for example by raising questions about the way counterfactual claims can, should, or should not be used in historical reasoning.

The book's fourth part confronts the inevitability thesis where it is ostensibly strongest: mathematics. Jean Paul van Bendegem contends that mathematics does indeed have contingent elements by developing alternative accounts of a) complex numbers, and b) the possibility proof-free arithmetic. Jean-Michael Salanskis describes why people think mathematics is inevitable, before turning to his case that we nonetheless have flexibility within the “frameworks” we use to interpret mathematical axioms. Finally, Ian Hacking takes a step back to consider the contingent elements of what we count as mathematics. Although it appears as the epitome of the a priori, mathematics is a discipline, and the boundary conditions of that discipline, and to some extent its internal divisions and hierarchies—e.g. between pure and applied science—are based on contingent factors, such as the political conditions in ancient Athens and the growing role of computation in modern mathematics.

Whereas taking contingency into the realm of mathematics might be considered a sharpening of the focus on physics that has framed the C/I problem, part 5 addresses Allamel-Raffin and Gangloff's call to expand the discussion into other sciences. Michel Bitbol and Claire Petitmengin discuss the contingent nature of the methods used to develop psychological understanding through the twentieth century. Joseph Rouse, suggesting that “taking physics as a stand-in for science in general may ... prove misguided” (324), deploys a range of examples, including some from biology, to argue that a focus on scientific practice is essential for understanding and arbitrating contingency claims. This section further reinforces the idea that The C/I problem is widely relevant beyond the ontology of science and provides a useful rubric for understanding how science is practiced.

The sixth and final section concerns itself with pluralism. Jean-Marc Lévy-Leblond and Hasok Chang both challenge the monist tendency of modern science. For Lévy-Leblond, the ways in which physical theories, in particular space-time theories, have been articulated mathematically exhibit a great deal of polymorphism, which suggests that the manner of their development is contingent. Chang presents the case for pluralism, understood as the active cultivation of many alternative scientific traditions (Chang 2012), in the vocabulary of the C/I problem. A pluralist

approach, he suggests, would offer a way to arbitrate contingency claims by providing a rich foundation of actual alternatives to evaluate. The connection between contingency and pluralism, like the connection between contingency and realism, is less about elucidating the C/I problem than it is about showing how it connects with other conversations in philosophy of science. Discussions of these connections nevertheless advance this book's aim to state emphatically the C/I problem's importance.

The ease with which many of this book's authors connect the C/I problem to established areas of philosophical interest bodes well for the C/I problem as a continued and lively area of research. And, indeed, this volume presents a number of questions that demand further investigation. How, for instance, should we approach counterfactual reasoning when elaborating cases from the history of science? Counterfactual history has received renewed attention from historians of science recently (Bowler 2013, Raddick 2008), but a careful synthesis of the philosophical tools developed in the context of the C/I problem and insights from historical methodology awaits. As many contributors to this volume note, the notion of 'success' remains to be elaborated, especially if it is to be used in a way that is agnostic about truth. And this volume both acknowledges and illustrates the disproportionate emphasis on physics that has shaped discussions of contingency. Detailed work on other sciences is much needed.

Examining this volume as a whole reveals two key advantages of the C/I problem that anyone taking up these questions would enjoy. First, thinking in terms of types and degrees of contingency offers the possibility of closer, more productive linkages between history and philosophy of science. Second, it provides a philosophical approach sensitive to all the details and idiosyncrasies of scientific practice, much like social constructionism, but avoiding deep assumptions at the outset about the epistemological status of scientific knowledge. It is also clear that discussions of contingency and inevitability are at their most interesting and useful when understood as distinct from the realism/anti-realism debate. The latter has never quite escaped the Manicheism of the science wars. Like the internalist/externalist divide in history of science, it appears too pat in light of the more sophisticated understanding of scientific practice that has emerged in the past few decades. The C/I problem's flexibility, which makes it more sensitive to history and practice, also make it a better suited to a more methodologically ecumenical (if not pluralist) context.

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