Katerina Ierodiakonou and **Sophie Roux**, eds.
Thought Experiments in Methodological and Historical Contexts.
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The use of thought experiments (TEs) in philosophy has recently become a frequent point of discussion, mainly because of the rise of X-Phi, or Experimental Philosophy, which has set out to put TEs to new work. There have been several rallying cries against the X-Phiers, in part because some of their projects have taken an uncritical look at the nature and epistemology of TEs while at the same time using them in new empirical ways (for example, gathering data sets of varying demographic groups' opinions in response to being told a TE). *Thought Experiments in Methodological and Historical Contexts*, edited by Katerina Ierodiakonou and Sophie Roux, will help those interested in the nature of TEs for the reasons suggested in its title: the volume brings together a range of chapters by various authors to examine the nature and use of TEs in the history of philosophy and science, and to explore some methodological issues about them. Although only one of the chapters directly deals with the recent controversies amongst philosophers regarding the *a priori* versus *a posteriori* use of TEs (Pascal Engel's "Philosophical thought experiments: in or out of the armchair?"), most of the papers in one way or another do some work to achieve the goal articulated by one of the editors, namely, to get an historically informed sense of the criteria constituting TEs. As Sophie Roux suggests in her introduction, "the protagonists of contemporary debates talked at cross purposes because they did not have the same characteristics of TEs in mind, or were not thinking of the same TEs" (27).

After providing an informative overview of the "confused origins" of scientific TEs, Roux suggests three criteria that a TE must meet: first, it is counterfactual; second, by utilizing our imagination it conjures a concrete scenario; and third, it (unlike mere fictions) has a well-determined cognitive intention. Roux is not trying to provide a definition of a TE, but urges that these three criteria are, to varying degrees, required for something's being identified as a TE (versus, say, an extrapolation or idealization). She suggests at the same time that the criteria in combination set up a tension, although this suggestion is elaborated only by two unanswered questions. A quick answer seems available to one of them: "if a thought experiment has a well-delimited cognitive intention, why worry about concrete details that obviously do not change anything in its result?" This does not seem like any tension whatsoever, since either we worry about the concrete details for the sake of the well-delimited cognitive intention (such as when we specify whether we push or let fall the body that will stop the trolley), or for rhetorical or epistemological purposes (such as when we supply details in order to facilitate something's imaginability). The second tension, whether we can "know anything" about the world on the basis of a TE's counterfactual reasoning, seems to vary from case to case, and seems especially troubling only for strongly counterfactual (i.e., bordering on metaphysically impossible) scenarios.

The three sections that divide the book are grouped as follows. In the first, "Historical Uses of Thought Experiments", the authors survey ancient and medieval uses of TEs. Ierodiakonou's "Remarks on the history of an ancient thought experiment" traces the appearance

of a seemingly similar TE – "the first recorded TE, the ancient TE of the man who stands at the edge of the universe extending his hand or his stick" – in its various versions. The versions are structurally the same in that "all cases present us with a dilemma after the positing of the initial assumption" (e.g., whether the universe is infinite or not), but Ierodiakonou's careful analysis displays the subtle ways in which they differ in their details. Tellingly, and incidentally in response to the purported tension raised by Roux in the introduction, the differences in detail appear to be purposefully tailored to suit the demands of the various ancient physical theories, such as whether the man throws a spear at the edge of the universe or merely extends his hand or stick. The detail matters: for example, Lucretius' shift to spear-throwing (rather than arm extension) "not only supports the view that our world does not have a fixed limit, but it is also sensitive to the Epicurean doctrine that there are infinitely many worlds". Whether the TE in its various ancient guises can be seen as the *same* TE playing itself out against different background assumptions and for different ends is an interesting question, and it highlights the importance of analysing the use of the TE against the intellectual contexts and commitments (e.g., Epicurean, Stoic) of its use.

Two articles round out this section. Peter Lautner's "Thought experiments in the *De anima* commentaries" raises a few interesting points, but the examples he draws from these late ancient commentaries seem furthest from what are typically now recognized to be TEs and more like straightforwardly illustrative examples. Lautner recognizes that these might be, at best, weakly counterfactual cases; the point might be pressed further, since there is nothing *experimental* about the passages he discusses. C. Grellard's "Thought experiments in late medieval debates on atomism" is a rich store of fourteenth century TEs motivated by a growing interest in atomism. Grellard provides a detailed analysis of the character, aims, and uses of these experiments. Especially intriguing is the overlap between medieval and contemporary strategies in dealing with TEs: for example, John Buridan's strategy against the argument of the sphere in which Buridan engages in a logical refutation of the TE in order to show the argument it contains to be invalid "due to some semantic mistakes".

The chapters in Part Two, "The Possibility of Thought Experiments", carry on to discuss TEs drawn from the history of philosophy and science, but (it seems) have been separated into a new section because the subjects of these chapters are explicitly concerned with methodological issues regarding the character and use of TEs. Each of the chapters in this section is highly detailed and cannot be reviewed in kind here, but some highlights should engage interested readers. In their article "Thought experiments and indirect proofs in Averroes, Aquinas, and Buridan" Simo Knuuttila and Taneli Kukkonen note the significance of the development of theories of "synchronic alternatives and the centrality of compossibility and co-assertability, [which] was especially conducive to the devising of all kinds of thought experiments in natural philosophy", but emphasize that another model for conceptualizing thought experiments also existed in the Aristotelian tradition and deserves attention. After discussing ancient counterfactual hypotheses, the authors explicate the views on impossible propositions and indirect proofs by the twelfth century Islamic philosopher Averroes. Ancient and medieval philosophers were intrigued by Aristotle's reliance on indirect proofs throughout his books on natural philosophy, "proofs in which Aristotle invoked thought experiments of various kinds, and they also found it curious that these thought experiments often involve hypotheses which contradict principles elsewhere described as necessary" (84). Averroes, intrigued by the claim in

Physics VII.1 that "this can be done because the impossibilities in question are assumed to be possible", set out to make sense of things and comes up with a curious solution. Also in this section is C. R. Palmerino's "Galileo's Use of Medieval Thought Experiments" and S. Virvidakis' "On Kant's Critique of Thought Experiments in Early Modern Philosophy".

Part Three of the volume engages metaphilosophical questions about TEs. Pascal Engel takes up T. Williamson's proposal that a philosophical thought experiment is "just a piece of ordinary counterfactual reasoning". Broadly sympathetic to Williamson's characterization, Engel entertains and then responds to a number of objections to the counterfactual thesis. However, Engel presses Williamson's contention that thought experiments have nothing to do with conceptual modality, a view to which Williamson is committed given his rejection that philosophy is an a priori discipline. But, Engel aptly notes, until there is consensus about what (for example) knowledge, or identity, or parthood are – just the kinds of issues that philosophical thought experiments are supposed to inquire about – then some conceptual analysis will remain part of the reason for using thought experimentation. J-Y. Goffi and Roux's "On the very idea of a thought experiment" posit three conditions for successful thought experimentation, emphasizing the important role that context plays in thought experimentation. Finally, J. Zeimbekis provides some helpful conceptual clarification, distinguishing between process-driven simulation, mental modelling, visualization, implicit knowledge, induction, and inference. His observations about ethical thought experimentation deserve further consideration.

Ierodiakonou and Roux deserve praise for assembling an historically informative and conceptually provocative volume.

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