Book Review

Frank Zenker. 2009. *Ceteris Paribus in Conservative Belief Revision: On the Role of Minimal Change in Rational Theory Development.* [Series: Europäische Hochschulschriften Reihe 20: Philosophie • Vol. 731] Frankfurt: Peter Lang Publishers. (Pp. 145; ISBN-13: 978-3631572832; €34.00 US$49.95)

The aim of *Ceteris Paribus in Conservative Belief Revision (CPCBR)* is to "contrast or minimally mutilating revisions of empirical theories" as this is understood in Alchourrón, Gärdenfors and Makinson's theory (AGM) of belief revision. A published revision of Zenker's PhD dissertation, the book looks at a narrow aspect of theory development embodied in the relatively recent literature looking at rational changes in beliefs in response to new information. AGM aims at expounding the minimal properties such a belief revision process ought to have. The author claims the book can be followed or understood without presupposing background understanding in formal logic. It should be noted, though, that such a background is helpful as Zenker's text is chalk full of highly technical language. This reviewer was thankful for having some exposure to formal and axiomatic systems. The book should be of interest to philosophers and historians of science alike, not to mention informal logicians, argumentation theorists, and epistemologists to be sure. Some background familiarity with philosophy of science concepts would be an asset in reading this book.

The book is divided into six chapters, any of which reads well as a stand-alone section. The first chapter, "Entrenchment and Scientific Change," introduces nicely the concept of epistemic entrenchment and its role in scientific reasoning and change. Simply, how does one handle a discovered inconsistency within a belief-state K, a logically closed set of propositions? Zenker points out the ramifications of adopting a Duhem-Quine approach to this situation that moves away from conjunctive connections among the members of K to an ordering relation on K such that some elements of K are more *entrenched* than other elements of K. In other words, entrenchment contributes to theoretical importance. In order to develop this sense of entrenchment, Zenker introduces, axiomatically, epistemic entrenchment and then shows how a particular ordering relation specifies epistemic entrenchment, especially in light of historical examples.

Chapter 2, "Epistemic Entrenchment vs. The Specialization Relation", explores two different approaches to modelling differentially entrenched elements of a theory or logically closed and consistent set of propositions. In order to assess the expressive power of AGM's ability to capture the least entrenched, and most vulnerable, proposition in *K,* Zenker's rigorous analysis and comparison to *structuralism* indicates that AGM is no better than structuralism, both in regard to *theory-nets* and to *theory-strings*. The historical background in this chapter is Newtonian Particle Theory.

Turning to the lively historical example of attempts at reconciling Newtonian mechanics with Mercury's anomalous orbit, Chapter 3, "The Mercury Anomaly and Minimal Revision", examines conservative revision. Conservative revisions are exemplified by the "hypothetical completion of antecedent conditions by so far unobserved gravitational masses." Like the Lunar Problem that plagued Newton (the moon perturbs in her orbit twice as much as Newton thought his theory could account), the perihelion advance of Mercury's orbit was met, until Einstein's Theory of General Relativity, with various gravitational solutions. These included alternative gravitational theories (gravitation equations include not only inverse square but maybe even lower order terms like inverse power of four, etc.), other planets within the orbit of Mercury, and reductions of gravitation to electrodynamics. Interestingly, in the historical accounts Newtonian mechanics is not thrown outright, but is said to be *minimally revised*. To what extent are these revisions minimal? Zenker is correct in pointing out that structuralist reconstruction fails in prioritizing the formal elements over the historical.

Building on the case study from the previous chapter, Chapter 4, "*Ceteris Paribus* as Completeness Assumptions", looks at whether the conservative revision of completing initial conditions with suitable hypotheses can be understood as contractions of a *ceteris paribus* clause. As such, these clauses would function as completeness clauses in which conservative revision hypotheses could be found.

The fifth chapter, "*Ceteris Paribus* Everywhere", extends Zenker's analysis of *ceteris paribus* laws. On his account, these laws are to be understood as formulations on the way to better theories. As a completeness assumption, it turns out that *ceteris paribus* plays an important role in testing a theory and explaining apparent exceptions (like the perihelion of Mercury). The chapter, if nothing else, provides a nice assessment of the important

discussions on theory choice and construction in the philosophy of science.

Finally, in ''The Myth and Reality of Minimal Change'', Zenker looks at two shorter case studies exhibiting conservative revisions to theoretical generalizations. The sixth and final chapter examines a revision to early thermodynamics as well as the idea of neutrinos in radioactive decay. On Zenker's account we move from *incommensurability* to the understanding that empirical theories *develop*. In the face of inconsistencies in *K*, it would appear that something has to be done, whether radically or conservatively. Zenker has illustrated instances where theoretical developments can be understood as minimal revisions. These illustrations, nonetheless, do not provide a strong case that minimal revisions *ought* to be the norm.

This is a book worth examining. Its highly technical perspective may make it inaccessible to some, however it does sit nicely at the intersection of philosophy of science and argumentation theory. The argumentation theorist unfamiliar the more technical aspects of the philosophy of science could actually begin the book in Chapters 3 and 4, and then move to the beginning. Finally, the reader should be prepared to perform a bit of formal ''calisthenics'' in reading Zenker's book. Although a background in formal logic and model theory are not needed, having some familiarity with formal logic and model theory certainly helps.

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