A Textbook of Belief Dynamics: Theory Change and Database Updating (Solutions Manual only) by Sven Ove Hansson

Excellent Guide To Belief Change!

The mid-1980s saw the discovery of logical tools that make it possible to model changes in belief and knowledge in entirely new ways. These logical tools turned out to be applicable to both human beliefs and to the contents of databases. Philosophers, logicians, and computer scientists have contributed to making this interdisciplinary field one of the most exciting in the cognitive sciences - and one that is expanding rapidly. This, the first textbook in the new area, contains both discursive chapters with a minimum of formalism and formal chapters in which proofs and proof methods are presented. Using different selections from the formal sections, according to the authors detailed advice, allows the book to be used at all levels of university education. A supplementary volume contains solutions to the 210 exercises. The volumes unique, comprehensive coverage means that it can also be used by specialists in the field of belief dynamics and related areas, such as non-monotonic reasoning and knowledge representation.

My Personal Review:
When was the last time that you changed your mind? I hope it was not long ago.
With this phrase, Sven Ove Hansson introduces the reader to the topic of his book: The Dynamics of Belief (usually referred to as belief revision or logic of theory change).
Who can be interested in belief dynamics? The list is long: philosophers that want a model for the behaviour of the rational agent with respect to his belief dynamics, or for the changes in scientific theories; legal theorists that seek a model that would represent the dynamics of amendments, promulgations or derogations in the legal codes; computer scientists that
want a model to formalize the notion of updating databases and knowledge bases; etc.
The belief dynamics was introduced in the late 70s, and the seminal paper of Alchourron, Gardenfors and Makinson 1985, where they presented the (later called) AGM model, became its main milestone. The AGM model was used as a formal framework to characterize the dynamics and state of belief of a rational agent.footnote{{Peter G{a}rdenfors}. Knowledge in Flux: Modeling the Dynamics of Epistemic States. The MIT Press, Cambridge, 1988.}. The beliefs are represented by sets of sentences closed under logical consequence (belief sets). Further works (in which Hansson was one of the most important researchers) extended the model to non-closed set of sentences (belief bases).
In the AGM framework, the dynamics of belief recognizes three basic operations: Expansion consists simply in adding a new belief to the corpus of belief. Revision, related to expansion, incorporates new beliefs, but, as opposed to expansion, consistency is preserved. Consequently, the revision process must eliminate enough sentences to avoid contradiction with the new belief. Contraction occurs when some beliefs are retracted but no new belief is added.
These changes have the following constraints (in priority order): \bf 1.\ Primacy of new information: the new information is always accepted \bf 2.\ Consistency: if possible, the new belief set must be consistent \bf 3.\ Minimal loss of previous beliefs: This criteria attempts at retaining as much of the old beliefs as possible. \bf 4.\
In the 80s the AGM model acquired the status of a standard model, and was characterized in at least five different equivalent ways: Postulates, partial meet functions, epistemic entrenchment, safe/kernel contraction and sphere-systems.\bf 5.\ In the 90s, the AGM model was extended, generalized and modified. Among these extensions, we can mention: Non prioritized belief revision, iterable belief change functions, withdrawal functions, modal logics for theory change, hidden structures of beliefs, etc..
In this book, Sven Ove Hansson made an exhaustive description of the AGM model and its equivalent presentations, both in belief sets and belief bases. He also included a wide compilation of the approaches mentioned above developed until the end of 1993 and some further developments. The book has two major achievements: It bridges the gap of a textbook on this subject (the only previous one was the mentioned Gardenfors book) and provides a deep study of the dynamics in belief bases, needed to apply the AGM model to real contexts.
The book is perfectly oriented to teach courses in belief dynamics, and provides a list of suggested courses (page 1) according to the level of the audience.
Each chapter is divided into two parts: the first one is more colloquial and useful to understand the intuitions, the construction and the purposes of the different approaches. The second one, marked in all cases with `+`, is devoted to the formal apparatus of the previous part. In the informal part, the theorems and properties are explained, but the proofs are left to the `+` parts (in some of them, new and more elegant proofs are provided).
Chapter 1 introduces belief dynamics and the basic tools needed to represent beliefs: logical consequence, belief sets, belief bases, expansions, remainder sets. Chapter 2 explains contraction, including the five AGM presentations and the representation theorems that show the equivalence among them. This chapter also opens the discussion to alternative models like Severe contraction, or Levis contraction. Chapter 3 is devoted to revision, its different presentations, alternative models and its relation with contraction. In Chapter 4, Hansson introduces an analysis which relates changes in belief bases to changes at knowledge level\footnote{See: \textit{Allen Newell}. The knowledge level. \textit{Artificial Intelligence} 18\textit{v} (1982), 87--127.}. Chapter 5 presents two extension for the representation language: modal sentences and conditional sentences. Introducing the latter in the representation of belief is incompatible with the Ramsey test. This incompatibility is well known as Gardenfors impossibility theorem. Chapter 6 introduces the reader to open problems.

To sum up, this book is an excellent guide to belief change researchers who need a summary of the area. It is also an excellent textbook for beginners who can read the book by following any of the courses suggested.

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