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Book Reviews

CAN BAŞKENT (ed.), **Perspectives on Interrogative Models of Inquiry**, Logic, Argumentation & Reasoning, Volume 8, Springer, 2016, vii + 197 pages, ISBN: 978-3-319-20761-2 (Print), 978-3-319-20762-9 (Online). DOI: 10.1007/978-3-319-20762-9

Jaakko Hintikka, born in Helsinki in 1929, is one of the great logicians and philosophers of the second half of the past century. Regarded as the founding father of formal epistemology and game theoretic-semantics, he also created *IF logic* (independence-friendly logic), known for its "branching quantifiers" and thus for being more faithful to our intuitions about quantifiers than first-order logic. His work also extends to the exegetical study of Aristotle, Kant, Wittgenstein, and Peirce.

Perhaps less known than these other results are the *Interrogative Models of Inquiry* (for short IMI) introduced by Hintikka in the 1980's (see [5, 6]). IMI is a model that describes scientific inquiry as an information-seeking process by means of asking questions and drawing inferences. Hintikka introduces the general structure of IMI using the terminology of game theory, interpreting scientific inquiry as a game between the Inquirer and Nature:

> The [interrogative] model can be described in game-theoretical terms. The model takes the form of a game which an idealized scientist, called the Inquirer, plays against Nature on a fixed model (universe of discourse). This model or "world" in practice is usually our actual world or some part of it. (Such parts as can serve as models of theories are often called in physics independent or isolated systems.) The game starts from a theoretical premise T. The Inquirer is trying to derive a preset conclusion C from T. At each stage, the Inquirer has a choice

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> between a deductive move, in which a logical conclusion is drawn from what the Inquirer has reached already, and an interrogative move, in which the Inquirer puts a question to Nature and registers the answer, when forthcoming, as an additional premise. Speaking of such questions is what presupposes that a model of the combined language of T and C is given to which the questions pertain. Nature's answers are assumed to be true in this model. [...] "questions put to Nature" are typically intended to be observations and experiments. [5, pp. 161–162]

Although less popular among researchers than other Hintikka's contributions, IMI has been a fruitful philosophical model. The book *Perspectives on Interrogative Models of Inquiry* aims to emphasize precisely this point by showing that IMI is a very rich theory which "has influence on many different subfields in logic and formal philosophy" [page v]. As far as I know, there is no other book dedicated to a detailed analysis of the IMI models; thus *Perspectives on Interrogative Models of Inquiry* constitutes an original and significant contribution to the literature. Moreover, given Hintikka's recent passing in 2015, this volume can also be seen as a last beautiful homage to an important philosopher and thinker.

Content of the Book

The book is divided into nine chapters, all written by excellent scholars in logic, philosophical logic and philosophy of mathematics. Each chapter (except chapter 9) connects to the IMI model from a different perspective. I will now briefly describe the content of each chapter.

The first chapter is that of Hakli who investigates the relations between inquiry and justifications. In particular Hakli draws a parallel between the IMI model for inquiry and the dialectical model for justification (see e.g. [1, 10]): inquiry and justifications can both be seen as social activities of questions and answers.

Genot and Gulz are the authors of the second chapter, where the links between the IMI model and inquiry learning theory are investigated. According to a study led by Hakkarainen and Sintonen (see [3]), the IMI model can describe children's practice in inquiry learning theories. Genot and Gulz question this result, pointing out that learning activities require not only deductive skills but also ingenuity and good luck.

The third chapter, written by Angere, Olsson and Genot, concerns jury systems. Two questions are raised; the first concerns the size of

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deliberating juries; the second the possibility of requiring more than a $> 50\%$ majority. In order to answer these questions, a model called *Laputa*, which is fundamentally Bayesian and decision-theoretic in nature, is adopted. The Laputa model indicates that requiring more than a $> 50\%$ majority should be avoided, and that it is always better to have larger jury. At the end of the chapter it is argued that the Laputa model can be seen as a generalization of the IMI model.

Başkent, the editor of the volume, is also the author of its fourth chapter. This chapter explores the parallel between IMI model and Lakatos's models of proofs and refutations (see e.g. [8]). Despite their differences, the two models share an important feature: they both rely on the existence of contradictions and inconsistencies to increase knowledge. Thus they both presuppose and are based on paraconsistent logic, to be understood as an umbrella term for the logical systems where inconsistencies do not trivialize the system. Although neither Hintikka nor Lakatos acknowledge this fact, Başkent uses the chapter to defend such a point.

The fifth chapter is dedicated to the links between logic and mathematics. According to van Bendegem, in order for logic to capture the underlying structures of mathematical practice, it is essential to understand that mathematics is a heterogenous discipline. Van Bendegem argues for this claim by analyzing two case studies: the first one concerns a mathematical puzzle, the second one concerns Diophantine equations. Moreover van Bendegem analyses the concept of mathematical explanation to give support to his thesis. IMI is the model where logic comes the closest to mathematical practice.

IMI is a dynamic model of scientific inquiry which is conceived as providing a logic of discovery. The sixth chapter, written by Antonelli, is concerned with an alternative model of inquiry which is based on defeasible rules. While Hintikka's model is subclassical, Antonelli's model is sopra-classical, thus allowing the inquirer to use the full power of classical logic. Moreover the most distinctive feature of Antonelli's model lies in the formal property of Cautious Monotonicity. Cautious Monotonicity allows the interrogative process to proceed in a cumulative manner: intermediate results can be used to obtain new ones.

The authors of the seventh chapter are Urbański and Wiśniewski and their starting point is Hintikka's claim that abduction constitutes the central problem of contemporary epistemology (see [6]). Urbański and Wiśniewski attempt to provide a logic for abduction by using So-

cratic transformations (see e.g. [11]) which are an alternative approach to Hintikka's idea of interrogative models.

Dynamic epistemic logic is an extension of modal or epistemic logic where dynamic processes are formalized (see e.g. [2]). Hamami, the author of the eight chapter, uses dynamic epistemic logic to capture the different epistemic operations constitutive of the IMI model. Hence, first of all, logic is used to formalize interrogative steps; secondly, logic is used to formalize deductive steps. Finally, the two approaches are merged together to obtain the formal counterpart of the interrogative model of inquiry. Soundness and completeness results ensure the adequateness of the framework. The author also underlines how his result differs and improves upon some previous related works.

The authors of the last chapter of the book are Naibo, Petrolo and Seiller and they deal with the issue of the verificationist theory of meaning. In particular they investigate the possibility of using Krivine's classical realizability (see [7]) as a verificationist interpretation of classical logic. In order to do so, they compare their approach, not only to Dummett and Prawitz's approach to verificationism (see e.g. [9]), but also, and more importantly for the volume, to Hintikka's approach to verificationism (see e.g. [4]).

Critical Comments

General structure. The book is well-structured in that it can be thought of as composed of three parts. In the first part, to which the first three chapters belong , the IMI model is linked to theories of general scientific interest. The second part, which contains chapters four and five, the importance of the IMI model for philosophy of mathematics is underlined. Finally in the third part, composed of the last four chapters, the IMI model, as well as other aspects of Hintikka's thought, are connected in various interesting ways to logic and philosophy of logic. We think that the volume would have profited from an introductory chapter dedicated to the explanation of the IMI model. This way the book would have been self-contained and thus perhaps more appealing for a larger public.

Main aim. In the preface of the book it is said that the book has three main aims, namely (i) underling the centrality of IMI in Hintikka's corpus (ii) showing that IMI relates to a wide range of domains in logic and philosophy (iii) showing the depth and breath of the IMI model. Başkent

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"leaves it to the reader to judge how much we managed to achieve our goals". As a reader, I should say that it is difficult to grant Başkent the achievement of goal (i) since no chapter has been dedicated to the relevance of IMI for Hintikka's thought, nor to the relations between IMI and other parts of Hinitkka's work. On the other hand, through this volume, Başkent has certainly achieved goals (ii) and (iii). Interrogative models of inquiry have indeed been linked to a variety of different areas of research ranging from dynamic epistemic logic to jury systems, from learning theories to mathematical practice. This not only emphasizes several analogies and relationships, but it also brings out the importance of IMI for philosophy of logic and philosophy of mathematics. We owe these interesting results not only to the authors of the nine chapters, but also to Başkent who has gathered together in a significant and clear way these contributions.

Index, footnotes and references. The volume does not contain any index. The number of footnotes is limited thus improving the readability of each chapter. As far as I can judge, the references are in most of the chapters accurate and complete.

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