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John MacFarlane. *Philosophical Logic. A Contemporary Introduction*. Routledge 2021. 258 pp. $160.00 USD (Hardcover ISBN); $44.95 USD (Paperback ISBN 9781138737655).

This book overviews some topics which are often discussed in philosophical logic, starting from the position of first-order 2-valued logic (FOL). The book is relatively short with the main text running just over 200 pages; thus, some of the topics get a somewhat cursory treatment. However, each chapter ends with recommendations for further readings, which will help readers to investigate further.

There are 8 chapters, accompanied with a six-page appendix (including a list of the 'more important' Greek letters), references and index. The first chapter deals with FOL. MacFarlane assumes that readers are familiar with the content of an introductory symbolic logic course, and he only reminds readers of basics and fixes some formal languages, notation and proof systems. Philosophers often prefer a natural deduction (ND) calculus for proofs, and MacFarlane follows suit, but opts for a *Fitch-style ND system* rather than Gentzen's arborescent original. A section is devoted to the use vs. mention problem and quotation marks (' ' and ⌜ ⌝). The difference between symbols and their meanings (denotations, etc.) was a puzzling question early on in modern logic; however, we may note that most of the contemporary literature in logic (as well as in mathematics and physics) balks at the idea of spattering the text with quotation marks. Indeed, ⌜ and ⌝ are typically used for Gödel numbers of expressions.

Chapter 2 deals with *quantification*. This topic is teeming with philosophical questions and allows MacFarlane to bring into sight connections to natural languages, 2-valued logics beyond the first-order and set theory. *Generalized quantifiers*, which are not expressible in FOL, can be easily exemplified by natural language phrases such as 'more *A*'s than *B*'s are *C*'s.' Some other quantifiers (e.g., 'as many *A*'s as *B*'s' or equinumerosity) have mathematical uses. The addition of certain (non-first-order definable) generalized quantifiers to FOL does not reach second-order logic (SOL), but the latter lends itself to a formalization of a wide range of quantifying expressions. The connection of SOL and set theory begs to be clarified, however, and MacFarlane only briefly touches upon it. He avoids discussing philosophical questions concerning any set theory, perhaps, because the most frequently used axiomatic set theories (von Neumann-Bernays-Gödel and Zermelo-Fraenkel) are traditionally placed under the label 'mathematical logic.' An alternative approach (without set theory) was provided by G. Boolos's *plural interpretation*: the truth of the statement 'There are some even numbers of which every number that is a power of two is one' does not imply the existence of a set of even numbers. Similarly, a SO formula '$\exists E(\forall x(2|x \equiv Ex) \land \forall y(Py \supset Ey))$' may be read — assuming some obvious choices of letters — as 'There is a property of being an even number [*E*] and every number that is a power of two [*P*] has this property.' Neither the formula nor the natural language quantification over properties requires the stipulation of the existence of sets. MacFarlane considers several other questions about quantification; the most exigent is the so-called 'substitutional interpretation of quantifiers.' Substituting names into formulas instead of interpreting variables is often employed in logic courses for beginners, because of the alleged simplification of the definition of truth (or satisfaction). As MacFarlane demonstrates, the substitutional interpretation is supposed to help to solve various philosophical problems from difficulties with denotation in a discourse about fictitious objects to problems about quantifying into quotes. The formal aspects of these problems are not detailed; thus, it is not surprising that critiques of the substitutional interpretation are not elaborated on either.

Modal expressions have been rendered using quantifier phrases long before the invention of contemporary modal logics by C. I. Lewis. Chapter 3 deals with *modal logics* — both propositional and quantified. First, Kripke-style semantics are introduced for normal modal logics, then six logics (**K**, **D**, **T**, **B**, **S4** and **S5**) are presented axiomatically and via conditions on the accessibility relation, and finally, as ND systems. Opposition to modal logics was aired by prominent figures like Tarski and Quine, in the late 20th century. Tarski's dismissal of modal logic was mostly latent; he simply failed to concern himself with modal logic when it could have been expected in light of his technical results. But Quine actively engaged in disputes about modal logic contending that modal logic, especially quantified modal logic, does not make sense, because formulas such as $\exists x \Box Px$ do not have a plausible interpretation. MacFarlane presents Quine's arguments that intend to show that it is a mistake to apply a modal operator to a formula with a free variable, and more broadly, modal and other intentional operators that create opaque contexts are not amenable to logical treatment. Two replies, perhaps the most widely known ones by A. Smullyan and S. Kripke, are also mentioned in some detail. There is no consensus in the literature about quantified modal logics (though propositional normal modal logics are generally accepted nowadays); however, problems arising point toward a need to go beyond FOL and its extensions.

The next chapter turns to the problem of *conditionals*, which highlights the limitations of the classical framework from another angle. Stoics are often credited with the introduction of the material conditional, which is 'not-*A* or *B*' in FOL. However, what was a profound innovation around the 3rd century BCE has been known, at least since Frege, to be an inadequate rendering of many sentences of the form 'if *A*, then *B*.' Everybody is familiar with funny examples like 'If 2 + 2 = 5, then the snow is crimson.' from introductory logic courses, where similar examples are used to reinforce the idea that only truth values matter. *Counterfactual conditionals* can be sifted out easily, though saying that they are not of the form $A \supset B$ does not elucidate their meaning. Some of the approaches overviewed directly connect to modal logics (e.g., Stalnaker's approach), whereas some others are closer to areas beyond logic (e.g., Edgington's explication involving mental states and probabilities). All these authors rely on natural language (typically, English) examples, and their intuitions about them. Some popular examples come with plenty of baggage, to the extent that their logically problematic character is glossed over. Since Aristotle, sentences about future contingent events are suspect as to whether they have a truth value. Still, examples such as 'If a Republican will win the election, then if Reagan will not win, Anderson will win.' are discussed as if the component sentences (e.g., 'Anderson will win.') had in the past (or have now) a truth value.

The so-called *paradoxes of material implication* are formulas that are questionable as logical validities, because ⊃ and logical consequence are tightly related in FOL. Chapter 5 is the first of two chapters that are devoted to *consequence*. Emphasizing the informal correctness of inferences, there is not much wiggle room to consider the varied notions of logical consequence. MacFarlane focuses on *truth preservation*, the absence of *counter examples* and Tarski's account of abstract properties of logical consequence. Then, in Chapter 6, ND systems are used as syntactic characterizations. Given that several ND systems have already been introduced, it is inevitable to ask how ND rules are chosen. A. Prior articulated this problem through the TONK connective, and Prawitz and Belnap gave formal criteria that exclude TONK. A scrutiny of the ND rules straightforwardly leads to the conclusion that intuitionistic logic (**J**) is more natural than FOL, because it does not require odious rules like double-negation elimination. **J** is presented as an ND system and interpreted via Kripke's semantics. MacFarlane considers translations between **J** and FOL — together with the ensuing conclusion that there is a plurality of logics rather than merely one unified logic capturing correct reasoning.

Chapter 7 deals with *relevance logics*, mainly, with first-degree entailments (**fde**), which is a common fragment of **T**, **E** and **R**. In this limited context, relevance logics closely resemble some other logics in which $A \wedge {\sim}A$ does not have an arbitrary B as its consequence. Although the *four-valued* (true, false, neither and both) interpretation of **fde** is mentioned, MacFarlane does not mention **K3** or **LP**, which can be obtained from **fde** by jettisoning a truth value. Neither are relevance logics, in which →'s occur in the scope of →'s, considered. Admittedly, relevance logics (e.g., **T**, **E** and **R)** require more intricate formal semantics than **J**, but they solve the paradoxes of ⊃ — unlike Lewis's modal logics.

The final chapter is about *vagueness*, a problem stemming from the sorites. Three approaches are introduced: 3-valued logic, fuzzy logic and supervaluations. Some of the well-known views (of Evans, Williamson and Quine) are discussed, but MacFarlane leaves it to the reader to decide which is the best solution.

The book covers a range of currently debated topics in philosophical logic, which are arranged in a *neat succession*. MacFarlane does not pretend to give an exhaustive account on any of the topics, nor does he advocate merely one approach to controversial problems, and he provides ample references. Some readers might wish for a more detailed account of some of the logics beyond FOL. However, as an introduction, this book will be useful for anybody who wishes to become acquainted with philosophical logic.

Katalin Bimbo, University of Alberta