Introduction

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The expression *philosophical logic* gets used in a number of ways. On one approach it applies to work in *logic*, though work which has applications in philosophy. On another, it is extended to include work in the *philosophy* of logic, including work on the semantics, metaphysics and epistemology of truth, logical truth and logical consequence, and work on the foundations of particular formal systems—including questions about what it is for something to be necessarily the case, or what a model is. *Philosophical logic* is also sometimes understood to include work in (and on the philosophy of) a broader class of formal systems, including game theory, decision theory, and probability calculi, and whatever else may be in view. We hereby decline to limit what counts as philosophical logic to any of these narrower conceptions: for the purposes of this volume *philosophical logic is the study of logic*—itself understood broadly—*and its applications, pursued to philosophical ends.*

Some days philosophical logicians may be attempting to understand the foundations of logic by examining its underlying assumptions, and critiquing how it is practiced. Other days we may be using the tools of logic to formally model some philosophical theory or phenomenon, to give new insight into some topic. All of this work bears a family resemblance, we admit it all as philosophical logic. In this volume we have collected some of the best examples of this work we could find, from some of our favourite young scholars in the field.

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The history of philosophical logic—through Aristotle and Frege to the great logicians of the 20th century and on to the army of philosophical logicians who now stand on their shoulders—is the history of one of the most productive and fruitful parts of philosophy. When the question of whether philosophy ever makes progress is brought up it is nearly always pointed out, and conceded where necessary, that at least *logic* makes progress. It is also true that the parts of philosophy that draw on the work of logicians make progress; modality, vagueness and definite descriptions might be some of the first topics to come to mind here, but as the kind of formal work that is done in philosophy has broadened we can add topics like action theory and the metaphysics of causation to that list.

Exactly *why* formal work has been the source of so much progress is less clear. Perhaps it is because philosophical ideas are generally difficult to communicate accurately, hampering debate and criticism, and mathematics provides a shared language for setting down our ideas. Perhaps it is that formal models force scholars to recognise the consequences of their views more quickly; it is relatively easy for a respected philosopher to get away with saying 'but *correctly understood* my view does not have undesirable consequence C' even though this was unclear from their original statement of the view and in fact they had never thought of the matter until some critic brought it up. But when someone produces a formal model of their view, the view's consequences are much easier for other scholars to discover and the benefits and limitations of the view therefore much easier to recognise. In his recent book *The Philosophy of Philosophy* Timothy Williamson encourages philosophers to use mathematical models *wherever* they can:

> Philosophy can never be reduced to mathematics. But we can often produce mathematical models of fragments of philosophy and, when we can, we should. No doubt the models usually involve wild idealisations. It is still progress if we can agree what consequences an idea has in one very simple case. Many ideas in philosophy do not withstand even that very elementary scrutiny... because the attempt to construct a non-trivial model reveals a hidden structural incoherence in the idea itself.

Perhaps it is also that we tend to lack discipline and any way of introducing it—including the use of mathematics and logic—will make us more consistent and more honest. Williamson again:

> Discipline from semantics is only one kind of philosophical discipline ... But when philosophy is not disciplined by semantics, it must be disciplined by something else: syntax, logic, common sense, imaginary examples, the findings of other disciplines (mathematics, physics, biology, psychology, history...) Of course, each form of philosophical discipline is itself contested by some philosophers. But that is no reason to produce work that is not disciplined by anything.

The methodology in philosophical logic is both (*a*) formal and (*b*) discursive. It shares with mathematics the rigorous, precise language of definitions, theorems, conjectures, proofs and counterexamples. However, papers in philosophical logic are not papers in mathematics. Even the most mathematical work in philosophical logic is set in a context in which it is applied to a philosophical issue, and in philosophy that site of application, that transition between the model and the phenomenon to which it is applied, is itself a proper subject of investigation. In philosophical logic we cannot simply take a ready-made formal system off the shelf to provide us a solution to a long-standing philosophical problem. Old formal modellings are critiqued, new ones are developed, and the

matter of deciding which account gives the best treatment of the phenomenon is itself a philosophical issue. Here, *discursive* considerations take over as we argue over the costs and benefits of different approaches.

When we practice philosophical logic with skill, the formal and the discursive modes of reasoning both constrain and enliven each other. The formal model provides a constraint and an example of what we can prove and what content our conjectures might have. Our imprecise and inchoate gestures, or philosophical stances on an issue, can inspire and inform the construction of new models, and can point us in the direction of different possibilities to examine. In the tension between the two, there is the energy for much forward movement.

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Whatever the explanation for the progress it has driven, formal work in philosophy also requires an unusual level of training to appreciate. Though there are a great many works of philosophy that would speak to an intelligent layperson—say Locke's *Second Treatise on Government* or Russell's *Problems of Philosophy*—much work in philosophical logic requires an education in mathematics plus several specialised courses at the graduate level before one can understand it. Even then, prior immersion in the relevant literature can make formal work much more accessible. Papers like Kit Fine's "Vagueness, Truth and Logic" or Kripke's "Semantical Considerations on Modal Logic" are not papers that one would recommend to an acquaintance who wanted to know a bit more about philosophy.[1] Moreover, the formal work itself is becoming increasingly specialised, making parts of it inaccessible even to people who are themselves philosophical logicians. One may be an expert on Bayesian causal networks without being an expert on dynamic logic, or an expert on computability without being an expert on non-finite probability theory.

Thus our topic presents the philosophically ambitious with a particular kind of problem: it is desirable to be acquainted with work in the area, because it is an established source of good and fruitful ideas. But it is extremely difficult to know where to start: there is just so much philosophical logic and it requires so much effort to follow.

The present volume is intended to offer one solution to this problem. We approached a group of the top younger scholars and asked them to present their best work in about 8000 words. The result is a collection of papers that represent 11 new ideas on a diverse range of topics. We won't claim that all of these papers make easy reading but if you are looking for new ideas in an area that is an established driver of philosophical progress, then we think that this volume is an especially rich and dense source of inspiration.

[1] This, we fear, makes progress in the topic hostage to general educational and political trends: in order for good work in logic be recognised and go on to inspire and allow further work, it is necessary that a certain kind of culture endure: we need enough good graduate schools training enough good students. It is unlikely that someone who did not have the training could recognise the worth of what is here sufficiently to rediscover it later and carry it on.

The Contents of this Volume

Berto's paper looks at a fundamental issue in logic, dating back to Aristotle—how to understand negation and exclusion. Berto is a friend of paraconsistency, the idea that inconsistencies need not all be treated alike, and that an inconsistent theory might nonetheless be non-trivial. Berto examines whether the paraconsistentist can genuinely rule things out, or if (as some have argued) once we accept paraconsistency we have no way to exclude another position. Perhaps unsuprisingly, the verdict is that it depends. There are different kinds of exclusion and there are different kinds of paraconsistency. Berto charts out the available logical landscape concerning paraconsistency and exclusion.

Cohnitz's paper examines the use of modal logic in providing rational reconstructions of cognitive processes, in particular its use in understanding the epistemology of modal claims. He argues that we require a variety of formal tools to explain our modal knowledge.

Dutilh Novaes argues that medieval theories of *obligationes*—a highly regimented form of oral disputation—have much to teach contemporary logicians. More generally, she makes the case that medieval logic can be a great source of inspiration—a point that will be familiar to the current crop of non-historians who have taken an interest in the history of logic more recently. Above we suggested that in order for current progress in logic to continue, the current research culture—from introductory logic all the way though to the most advanced post-doctoral seminars—would have to endure as well. The culture that gave rise to medieval logic only survived so long, so we are fortunate that some of the fruits of that culture are still accessible.

Eklund's paper sheds some light on the debate over logical pluralism. He proposes some tools for thinking about the debate, and then uses these to sharpen up one of the most substantial and interesting questions at issue in that debate.

Jehle and *Weatherson* reexamine the connection between justification, appearance and subjective probabilities. They take a look at the known result that according to classical accounts of probability, the options for dogmatism (in particular, the idea that agents can come to justifiably believe that p is true by seeing that it appears that p is true, without having any antecedent reason to believe that impressions are generally reliable) seem grim. They use Weatherson's notion of an *intuitionist* probability function to show that the options are greater if we abandon the assumption of classicality, and then show that we do not even need to endorse intuitionistic logic to get this result, but that mere uncertainty between classical and intiutionistic logic will do.

Kooi gives us a glimpse at the burgeoning field of dynamic logic, which looks at how we can update and revise bodies of information in the light of new findings. He shows that some old and difficult problems on the modal logic of names

and quantification can be recast in this new light.

Leitgeb extends his work on so-called 'type-free' accounts of probability and truth. A type-free theory of truth is one in which we can use sentences to express claims about the truth of those very sentences. In this paper, Leitgeb expands his earlier work on type-free theories which give us a account of the probabilities of sentences that speak about their on truth, to include the capacity for sentences to speak about their own *probabilities*. The resulting theories are have great expressive power.

Poggiolesi and *Restall* look at the way that different accounts of the structure of proof using the modal notions of possibility and necessity relate to one another and how different structures in the way that deduction is *used* correspond to different modal features familiar in the models of modal logics.

Roush, *Allen* and *Herbert* examine Humean skepticism, and in particular, the kind of skepticism which might emerge when we reflect not only on our available evidence, but on the reliability of our reasoning about that evidence. Hume offers a skeptical regress, which has been thought to lead us to extinguish all belief—to cast doubt on absolutely all statements, whether seemingly provable or not. Roush, Allen and Herbert examine this kind of argument, using the tools of probability theory, and show that while regresses such as this can cause concern, there is nothing inevitable in the vicinity. It may well be that reflection on the quality of our reasoning can lead us to *increase* as well as decrease our confidence in our belief.

In "Lessons from the Logic of Demonstratives" *Russell* draws out three consequences of Kaplan's logic LD. She argues that LD requires us to recognise that logical consequence is not really necessary truth preservation, gives a new argument against the linguistic doctrine of necessary truth and formulates and proves an indexical barrier theorem for LD, which she hopes will be of interest to philosophers who work on context-sensitivity.

Schwarz' "How things are elsewhere" defends counterpart theory against allegations that it is unintuitive, at odds with the linguistic evidence and inelegant as a modal logic. He shows how the internal "Amsterdam" approach to modal logics will allow us to think of counterpart theory as a generalisation of the standard Kripke model theory, one which is ultimately better at handling unintuitive "trouble cases", such as those involving time travel and fission.

In these papers the tools of formal logic are both used to philosophical ends in metaphysics, epistemology and the philosophy of language, and are brought under critical scrutiny themselves, as objects of philosophical reflection. We have learned a great deal about our field as we have read the papers, engaged with the authors and attempted to set them into their proper context. We think that the richness of approaches presented here from a new generation of

researchers in philosophical logic points to a bright future. This work marks out the great scope for further advances in our field, and, we think, contributes in no small measure to philosophy as a whole. We hope that as you read these papers, you will agree.