

Masses of Formal Philosophy
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1 Why were you initially drawn to formal methods?

My first contact with formal methods occurred when I was studying Popper's book *Conjectures and Refutations*. I discovered the induction problem and then I decided that I should study Hume's work to understand it. The *An Enquiry Concerning Human Understanding* showed me that, indeed, we have good reasons to accept that the world is contingent. My interest in empirical sciences was, therefore, destroyed because I was looking for answers that could not be false. At this time, I came back to the study of mathematics and logic because I supposed that I would discover the most general structure of reality and some necessary truths in these areas. I realized that I should study Wittgenstein's *Tractatus* because he had proposed a kind of philosophy where formal methods were the main tool. I studied the *Tractatus* and then I felt that it was exactly the kind of thing that I was looking for. Afterwards, I started studying contemporary formal philosophers and when I finished my undergraduate studies I wrote a monograph on Kripke's contributions to philosophy. Afterwards, in my Master's thesis, I studied Fitch's paradox and I proposed a solution to it using some non-classical modal logics.

2 What example(s) from your work (or the work of others) illustrates the role formal methods can play in philosophy?

I would mention, first, the role of methods for combining logics in philosophy. As Gabbay pointed out in *Fibring Logics*, we know that there are complicated statements in natural languages involving a lot of different concepts which cannot be formalized using a very simple formalism. Let me illustrate the problem.

Suppose, for instance, that we are trying to determine if the statement “Contingent propositions can be known” is true or not. This proposition has two different non-interdefinable modalities: contingency and knowledge. Thus, a simple epistemic logic cannot be used. We have to, at least, combine a logic for contingency with an epistemic logic in order to formalize the statement. Recently, there are a lot of methods for combining logics. My main research consists in applications of those methods in epistemology and metaphysics. I show how they can help us in the analysis of different philosophical problems, principles and concepts such as skepticism and some paradoxes.

Second, I would mention my project called philosophical categorification. Logic is a powerful tool which philosophers utilise to better understand their problems and concepts. As is well-known, the relationships between logic and category theory (in the sense of Mac Lane) appear in different levels: 1) logical operators can be represented in categories, since objects are propositions and morphisms are proofs (for instance the works of Lambek and Goldblatt); 2) logics can also be assumed as objects of categories where morphisms are translations (for example, some articles of Carnielli and Coniglio); 3) methods for combining logics are universal constructions in some categories where objects are logics (the approach developed by Sernadas and Caleiro). Indeed, there are in the literature some other examples of how category-theoretic concepts can replace logical concepts. However, given that logic is a very important tool in order to understand concepts from philosophical areas such as epistemology and metaphysics, a natural conjecture is that category theory can also play an important role in philosophy. Category theory is a tool which can be used in philosophical theories and itself has an ontological status (some attempts of applying categories in philosophy are those of Badiou, Marquis, Rodin and Reyes). Philosophical categorification is the philosophical counterpart of categorification introduced by some mathematicians (Dolan and Baez), but replacing logical concepts for categorial concepts, and also set-theoretic notions by category-theoretic notions in order to investigate philosophical concepts.

3 What is the proper role of philosophy in relation to other disciplines?

Philosophy can play a very important role especially in the process of generating news ideas and concepts. Also, philosophy helps in the analysis of main concepts of a given discipline. I should select an example: take the role of philosophy in mathematics, especially because this is a book on how mathematical methods can be applied to philosophical issues. Why not the converse process? Consider a mathematician who studies the concept of *set* and argues that sets are generated by a certain axiom. The mathematician decides to mathematically develop then an axiomatic set theory. When a mathematician examines the nature of a given axiom, its ontological content, why a set is really a set, how we can know the properties of a set and many other foundational questions, then philosophy

is playing a role.

4 What do you consider the most neglected topics and/or contributions in late 20th century philosophy?

On one hand, the applications of category theory in philosophy and the study of the philosophical content of categories are the most neglected topics in late 20th century philosophy. However, there are other hard problems which have been neglected and that will be probably forever neglected at least in the academic level: the meaning of life, what is death etc. The formal philosopher just ignores such problems. Maybe formal philosophy can even help in the treatment of complicated philosophical questions.

On the other hand, one of the most important contributions on how formal methods can play a role in philosophy is Kripke's argument that there are necessary *a posteriori* truths (necessary truths which can only be known *a posteriori*). This was a real revolution in philosophy, given that necessity was always related to *a priori* knowledge. This kind of philosophical progress was just possible because formal tools such as modal logic were playing a special role. Another contribution which should be mentioned is possible worlds semantics. Nowadays, it is very difficult to find a philosopher who does not use such a tool.

5 What are the most important open problems in philosophy and what are the prospects for progress?

This is a very interesting question. I think that the most important open problem in philosophy is to present some concrete examples of philosophical categorification and show that, therefore, category theory is a very general, abstract and important philosophical tool. The problem of generating a system of ontology (answering questions such as what is an object? what is a property? what is an adequate criterion of existence etc) using category theory is one of the most important open problems which can be solved. Some other examples are: how to define metaphysical and epistemic modalities without using possible worlds semantics? How to define the notion of contingency in a categorical approach?

However, there are real open problems, much more important than any other problem of any area of science, that no solution has been announced for centuries and looks like that the situation will not change in the near future: What is the meaning of life? What is death?