1. Why were you initially drawn to the philosophy of logic?

My interest in the philosophy of logic started when I attended, as an undergraduate student, the seminars of Professor Newton da Costa at the University of São Paulo. He made it very clear that careful philosophical reflection about logic cannot be done without proper attention to the many connections that logic bears not only to mathematics and the sciences, but also to ontology and epistemology. Very early on, it was clear to me that the philosophy of logic, properly done, goes hand in hand with central areas of philosophy, and that was a significant attraction for me. (The philosophy of logic is, of course, not unique in this respect. But this point is particularly striking about it.)

The philosophy of logic also allows one to explore extremely sharp and well-defined problems — several of which can be addressed formally — possessing a significant impact for larger areas of philosophy. It is intriguing how much can be learned about a certain sub-field by formulating some problems formally and then examining the significant impact their solutions have for the broader philosophical landscape. A classical example in logic (although, of course, it has huge consequences for the philosophy of logic) is Gödel’s incompleteness theorems. By formalizing the concept of provability, quite unexpected results regarding the incompleteness of arithmetic and the unprovability of consistency emerged — results that challenged deeply held assumptions about the philosophy and the foundations of mathematics.

The connections that the philosophy of logic has with other sub-fields of philosophy allowed me to explore, over many years, the issues it raises with collaborators working in logic, philosophy of science, philosophy of mathematics, and metaphysics. It has been, in fact, a privilege to collaborate with a number of terrific people on these issues.

Several motivations for the development of my views in the philosophy of logic emerged from discussions with Newton da Costa, who has a remarkable vision for so many significant issues in philosophy. I have
written many works with him, developing the details of the resulting views, ranging from non-classical logics (in particular, paraconsistent and non-reflexive logics) to quasi-truth and partial structures and their significance (see, e.g., da Costa and Bueno [2001], [2007], and [2009]).

Similarly important has been my collaboration with Steven French, with whom I developed various aspects of the use of logic for the understanding of salient features of scientific practice (particularly in terms of partial structures — another great idea of Newton da Costa’s — see, e.g., da Costa, Bueno, and French [1998a], Bueno and French [2011], and [2012]). With Scott Shalkowski I have explored the role that primitive modality plays in the proper understanding of logic, logical constants, and logical consequence. We have been developing a modalist approach to central areas of the philosophy of logic, and examining their implications for the philosophy of mathematics as well as the metaphysics and the epistemology of modality (see Bueno and Shalkowski [2000], [2004], [2009], and [2013]).

With Mark Colyvan, I have developed a framework to represent the application of mathematics (which we call the inferential approach), and which has significant implications for broader issues of scientific representation (Bueno and Colyvan [2011]), together with problems related to the revision of logical principles (Bueno and Colyvan [2004]) and semantic paradoxes (Bueno and Colyvan [2003a] and [2003b]).

With Décio Krause, I have explored the role played by logic in the proper understanding of scientific theories and their models (Krause and Bueno [2007] and [2010], and da Costa, Krause and Bueno [2010]) together with its significance for an account of scientific reasoning (da Costa, Krause, and Bueno [2007]). Many of these issues have been developed in collaboration with Newton da Costa. We thus reach a full circle.

2. What are your main contributions to the philosophy of logic?

My main contributions to the philosophy of logic, often developed in collaboration with those mentioned above, involve: (a) the defense of logical pluralism, (b) the emphasis on the significance of non-classical logics (particularly, paraconsistent logics) for the philosophical understanding of logic, and (c) the defense of logical non-apriorism (that is, the view that logical principles can be revised on non-a priori grounds). I will consider each of these points in turn.

(a) Logical pluralism is the view according to which there is a plurality of logics depending on the domain one considers, and, in fact, typically there are several logics appropriate to a given domain (see da Costa and Bueno [2001], Bueno [2002a], Bueno [2011a], Bueno and Shalkowski [2009] and [2013]). For example, to capture constructive features of mathematical reasoning, classical or paraconsistent logics are clearly inadequate, but intuitionistic logics are not. To accommodate inconsistent bits of information without triviality (that is, without deriving everything as well), intuitionist and classical logics are inadequate, but paraconsistent logics are not. To secure the strongest possible logic (with regard to the consequences that are obtained), paraconsistent and intuitionistic logics are not adequate, but classical logic is. (Of course, some non-classical logicians will typically question whether some such consequences are indeed valid. But that is part of the ongoing debate.)

In other words, the logical pluralist insists that there are several logics across several domains and multiple ones in a single domain too. For example, it is clear from Newton da Costa’s hierarchy of paraconsistent logics (the C-logics; see da Costa [1974]) that if a given particular paraconsistent logic is adequate for a particular domain, there are several others that are just as adequate. This does not mean, of course, that any logic is adequate for any domain. Logical pluralism is not logical relativism. Some logics are just inadequate for certain domains, that is, certain areas of inquiry (as the examples mentioned in the paragraph above illustrate).

(b) The philosophical significance of non-classical logics becomes clear in this context: these logics challenge the adequacy of certain assumptions made by classical logic and provide an alternative understanding of certain features of logic, such as the nature of logical constants (Bueno and Shalkowski [2013]), the scope of logical principles (da Costa, Bueno, and French [1998b]), da Costa and Bueno [2001], da Costa, Krause, and Bueno [2007], and Bueno [2010a]), the interpretation of quantifiers (da Costa and Bueno [2009]), as well as the role of models and primitive modality in the proper formulation of logics (Bueno and Shalkowski [2009] and [2013]).

(c) The possibility of revising logical principles on non-a priori grounds is also a significant aspect of my work in the philosophy of logic (da Costa and Bueno [2001], Bueno and Colyvan [2004], and Bueno [2010b]). Although logical principles are accepted on a priori grounds, they can be revised due to non-a priori — and, in some instances, even empirical — considerations. The crucial point is that for the acceptance of a logical principle, no empirical considerations are needed. It is ultimately a matter of considering the relevant logical form. (Note that I am talking about acceptance rather than full justification. It is arguably unclear how to establish any such unquestionable justification.) However, when applied to a particular domain (e.g. to describe some specified objects and their relations), the principles or inferences in question can yield the wrong results. In this case, a revision of such principles or inferences is in order. For example, empirical considerations lead
to a revision of the distributivity law in the foundations of quantum mechanics (see Putnam [1979], da Costa and Bueno [2001], and Bueno and Colyvan [2004]).

It may be objected that we need some logical principles to adjudicate between other logical principles. In this case, how is it possible to revise the contentious principles without somehow begging the question? In response, the central idea is that we can always adopt, pragmatically, some other logical principles to assess the consequences of the controversial ones. We need not assume, say, excluded middle while reasoning about what follows from its adoption. And through these considerations, it is eventually possible to assess the principles in question, and as a result, to revise them.

It should be clear now that logical non-apriorism, logical pluralism, and the philosophical significance of non-classical logics all go hand in hand. They are mutually supporting views about logic and provide a unified approach to philosophical problems in the field.

3. What is the proper role of philosophy of logic in relation to other disciplines, and to other branches of philosophy?

The philosophy of logic, as I mentioned above, has important connections to other branches of philosophy, such as: (i) metaphysics, (ii) epistemology, (iii) philosophy of science, and (iv) philosophy of mathematics. I will consider them in turn.

(i) Careful philosophical reflection about the nature of quantification cannot be done without attention to the underlying metaphysics. For instance, it seems that classical quantification presupposes the identity of the objects that are quantified over. However, non-reflexive logics, which do not assume that identity applies to every object in their domains, have no such presupposition. This raises the possibility of understanding the relevant quantifiers without presupposing the identity of the objects in question (see da Costa and Bueno [2009]). Moreover, an adequate specification of the scope of logical principles requires a clear understanding of modality (Bueno and Shalkowski [2009]), and the same goes for the characterization of logical constants (Bueno and Shalkowski [2013]). After all, if certain possibilities are allowed, such as inconsistent situations, then certain principles of classical logic are violated (such as explosion, according to which everything follows from a contradiction). As a result, the scope of these principles needs to be restricted, and different logical constants can then be introduced.

(ii) An important goal of philosophical reflection about logic is an account of our knowledge of logical principles. Clearly, this cannot be done without attention to epistemology, and by engaging, in particular, with accounts of a priori knowledge (Bueno [2011b]). Some views of the epistemology of logic require metaphysical assumptions about the nature of the objects under consideration (propositions, facts, universals). This poses a particular difficulty for the resulting epistemological views, given the need for explaining how the knowledge of the relevant objects is possible. Other views do not have such metaphysical commitments. They need then to explain what logical knowledge is about, and distinguish those who have a lot of it from those who do not (see Field [1989], and Casullo [2003]).

(iii) Philosophical views about logic also bear important connections with the philosophy of science. To make sense of scientific reasoning and different styles of reasoning within scientific activity, a proper understanding of logic seems crucial (see Bueno [2012b]). After all, depending on the logic one considers, different styles of reasoning may emerge. For instance, constructive and non-constructive styles of reasoning are importantly different, and these differences emerge, in part, from the different conceptions of logic at issue. Similarly, to understand the various roles that models play in scientific practice, including their heuristic role in theory construction and theory development, an account of the philosophy of logic is also significant (see Bueno, French, and Ladyman [2012a] and [2012b], da Costa and French [2003], and da Costa and Bueno [2009]). After all, which models can be formulated depends on the particular framework that is used to characterize them, and the expressive resources of the framework, in turn, depend on its underlying logic. But the choice of the logic in question is made, in part, on the basis of its philosophical understanding and the overall resources it provides.

Another important aspect of how philosophy of logic is connected with the philosophy of science is in the understanding of the relationship between mathematical and empirical features in the explanation of phenomena (Bueno and French [2011] and [2012], Bueno, French and Ladyman [2002], and Bueno [1997]). A class of such explanations involves transferring of structure from one domain to another. The resources available for implementing such transfers also depend on the framework that is used to formulate the relevant models, which, as just noted, also depends on the underlying logic that is adopted. Typically, in science the underlying logic is classical. But since in some cases non-classical logics can be used, the issue of changing the underlying logic becomes relevant. More generally, understanding the process of theory change and belief change, including the role of inconsistencies in this process, also requires a proper account of the underlying logic and its nature. These are, of course, philosophical issues about logic that also bear on general problems in the philosophy of science (see da Costa and Bueno [1998], [2001], and [2007], and Bueno [2000], [2002b], and [2006]).
(iv) Finally, philosophical conceptions about logic often go hand in hand with views in the philosophy of mathematics (see Bueno [2012a], [2005], [2001], and [1999]). Logicism is, of course, an obvious example, given its attempt to reduce arithmetic to logic (see Frege [1884/1950], Hale and Wright [2001], and Bueno [2001]). Those who favor second-order logic can also argue that, properly interpreted in terms of plural quantifiers (Boolos [1998]), and given its expressive resources, second-order logic can be used to provide a defense of nominalist views that avoid commitment to abstract objects in mathematics (Field [1980], Bueno [2010a], and Bueno [2009]). The logic is made stronger (expressively), but the ontological commitments are reduced.

4. What have been the most significant advances in the philosophy of logic?

There have been a number of significant advances in the philosophy of logic. I will mention a few of them.

(i) The development of plural interpretations of second-order quantifiers and their applications (Boolos [1998], Lewis [1991], and Linnebo [2003]). This interpretation of monadic second-order logic revived the interest in philosophical discussions of second-order logic, and has implications for discussions of nominalism and platonism in the philosophy of mathematics, the interpretation of set theory, and the relation between natural language and formalized theories (for a helpful survey, see Linnebo [2012]).

(ii) Challenges to the model-theoretic understanding of logical consequence and responses to those challenges (Etchemendy [1990], Sher [1996], Gomez-Torrente [1996], and Bueno and Shalkowski [2013]). The model-theoretic approach to logical consequence is, arguably, the most widely accepted view in logic and in its philosophy. Challenges to it have identified hidden assumptions and difficulties. Not surprisingly, the responses have attempted to offer robust answers to the troubles that were raised. Even if the original objections may not go through, there is something fundamentally right about the challenge.

(iii) The defense of certain forms of nominalism about logical formalism (Azzouni [2006]). This is a significant difficulty for any nominalist view, and needs to be properly addressed by any fully developed form of nominalism (both in mathematics and in logic): how can nominalists make sense, nominalistically, of the very formalism they use? As I will note below, although significant advances have been made in this area, there are still significant issues to be addressed (needless to say, this is true of virtually any noteworthy philosophical problem!).

(iv) The development of different kinds of logical pluralism (da Costa and Bueno [2001], Beall and Restall [2006], and Bueno and Shalkowski [2009]). One of the most extraordinary facts about logic in the last century is the plurality of logical systems that have been developed. A careful philosophical reflection on this fact and its significance is crucial to a proper understanding of logic and its nature. Interestingly, there are different kinds of logical pluralism: some emphasize cases, others stress domains; some incorporate primitive modality; others do not.

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

There are several important open problems in philosophy of logic. I will mention two.

(a) A proper understanding of logic requires a metaphysics. But which metaphysics is a significant open problem. Many influential views about the foundations of logic incorporate metaphysical commitments of a problematic sort: abstract objects, universals, facts, and propositions are just a few examples of such commitments. They require a proper account of the epistemology of such objects, one that goes hand in hand with an account of our mechanisms of access to the relevant entities. These views are Platonist in the sense that they posit non-spatiotemporal, causally inert entities, whose knowledge ultimately requires explanation. Platonist views about logic try to address this issue, but with only some degree of success. After all, in the end, it is unclear that they really succeed in establishing knowledge of the relevant objects. Nominalist views similarly attempt to provide a solution. But they still face difficulties. For it is unclear that the account of logic consequence they provide ultimately works. A fundamentally different approach seems required to move us beyond such stalemate.

(b) Another significant open problem is the understanding of the role played by logic in styles of reasoning used in the sciences and in mathematics. This question is partially conceptual, partially empirical. It is conceptual in that it requires a proper characterization of the variety of such styles and their connections with particular logics (when appropriate). In some cases, the connection is clear enough. For example, constructivism — as an approach to the foundations of mathematics and as a philosophical view about the nature of mathematics and logic — provides a distinctive style of reasoning. Not surprisingly, its associated logic is intuitionist. In other cases, however, the situation is more complex. After all, the same logic may be associated with different styles of reasoning. The difficulty then consists in determining which logic (if any) is being used, and to provide a proper philosophical account of the situation.
But the problem of understanding the role played by logic in styles of reasoning is also empirical in that it depends on particular traits of actual scientific and mathematical practice, and the proper study of these traits. Any such study will involve a logic and, thus, considerations regarding the choice of logical principles and how to settle foundational debates about logic will need to be invoked as well. This is philosophy, after all. We are always at sea.

Bibliography


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